

***“There are fighters and there are  
targets. There is nothing else.”***

- John A. Fergione, Experimental Test Pilot  
Lockheed Martin Tactical Aircraft Systems

Internet Address: [www.LMTAS.com](http://www.LMTAS.com)



# ***F-16***


## ***Multirole Fighter™***

### ***User Manual***



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F16 Multirole Fighter now features the holographic Wide Angle HUD specially designed to support the LANTIRN pod. Although the screenshots in this manual show the former Head-Up Display, all text annotations and delineating symbology remain true.

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# Introduction

Thank you for purchasing **F-16 Multirole Fighter**, the latest fixed wing simulation from NovaLogic. To make the best possible game, our design team went straight to the experts at Lockheed Martin Tactical Aircraft Systems. With the invaluable aid of their professional consultation, we are able to bring you the most exciting and easy to use F-16 PC flight simulation without sacrificing authentic characteristics such as the unique flight model.

The **F-16 Multirole Fighter** is the best the world has to offer when it comes to true multi-mission fighter planes. Capable of housing a larger variety of ordnance and fuel pods than any other fighter aircraft, the F-16 adeptly handles a wide range of tasks. Air-to-Air missiles such as the AMRAAM and the AIM-9M Sidewinder along with a unique, high maneuverability body blend make the F-16 a formidable opponent in air combat and interception. Laser and Infrared guided bombs and missiles such as the GBU-10 and the AGM-84 Harpoon allow the F-16 to be used in precision ground strikes and maritime interdiction. Advanced detection instruments such as the LANTIRN and FLIR permit the aircraft to operate fully at night in all weather conditions. The current F-16 can do it all.

Originally intended to be a lightweight air-to-air fighter, the F-16 first flew in January of 1974. Over its long lifetime, it would see continual upgrades and refits to its body/tail design, engines and detection systems. This helped transcend the F-16 into a superbly effective multi-mission aircraft.

The current service record speaks for itself. With an impressive 69-0 kill ratio and an average peacetime mission success rate of 88%, the F-16 is a proven asset. Due to the nine highly configurable hard points, the USAF continues to use the F-16 to test new forms of advanced weaponry. To this day, F-16s have been successfully utilized in enforcing U.N. no-fly zones over Iraq. With a price tag of under \$20 million (and considerably less for NovaLogic's version of the F-16), it is no wonder why 20 air forces around the world choose the F-16.

We hope that you enjoy the thrill of piloting the versatile and powerful **F-16 Multirole Fighter** as much as we enjoyed creating the game.



## Chapter 1

# Installing F-16 Multirole Fighter

Welcome to **F-16 Multirole Fighter**. This chapter of the manual will help you get the program installed on your computer, and will walk you through the configuration of your system. The next chapter is a **Quick Start** section, for those of you with significant flight sim experience, or for those who want to jump right in and learn by doing.

In order to play **F-16 Multirole Fighter**, you must first install the game files onto your computer's hard drive. You should also calibrate your joystick before beginning play.

### **Game Installation**

Your gateway to installing and running **F-16 Multirole Fighter** is the AutoRun program. AutoRun will automatically load itself and run each time you insert the **F-16 Multirole Fighter** CD into your CD-ROM drive. **F-16 Multirole Fighter** uses the Install Wizard to place the necessary files on your hard drive.

### **The AutoRun Program**

Before you begin installing the game, close all programs that your computer may be currently running. The installation program requires all of your computer's resources. Then:

- 1) Place the game CD into your CD-ROM drive and close the drive door. The AutoRun program will now take over. If you have turned off the AutoRun feature or if the Autorun fails to launch automatically, double-click on the **"My Computer"** icon on your desktop and then double-click on your computer's CD-ROM drive letter. This should launch the **F-16 Multirole Fighter AutoRun**.
- 2) Click the mouse on one of the menu choices, or type the letter corresponding to the underlined hot key. The AutoRun menu gives you the following choices:

**Start F-16 Multirole Fighter**—Select this option to play the simulation. You will first have to install the program on your hard drive.

**Install F-16 Multirole Fighter**—Select this option to install the simulation onto your hard drive. You must install the game before you can play. This will also automatically install the Mission Editor at the same time.

**View Readme**—The Readme file contains the latest technical and game-related information about the program.

**Start Mission Editor**—Select this option to create new missions for your F-16. To learn how to use the Mission Editor, please refer to the Adobe Acrobat file included on the CD.

**Explore CD**—This CD also contains informational files and demos of other NovaLogic games. Use this option to see the contents of the CD.


**Install DirectX**—Make this selection to install DirectX™ onto your hard drive. You must have DirectX 5.0 or greater installed on your machine to play **F-16 Multirole Fighter**. Multiplayer games require DirectX 5.0 or greater. Windows NT requires Service Pack 3 (obtained at the Microsoft Website) to play single player and Internet multiplayer.

**Exit**—Exits the AutoRun program.

When you are ready, select **Install F-16 Multirole Fighter**.

## ***Installing F-16 Game Files***

Use your mouse to make the appropriate selection, or press the letter of the underlined hot key.

- 1) At the beginning of the installation program you are given the opportunity to select a destination folder for the game. A default is typed in the window for you. Press the  key to select the default destination. Otherwise, select your own folder name. If the folder you specify does not already exist on your hard drive, the Install program will create it for you. Further installation instructions will appear onscreen.
- 2) If there is enough free hard drive space at the destination site, the program will copy the files from your **F-16 Multirole Fighter** CD-ROM. An on-screen progress meter displays the completion percentage as the program transfers the files.
- 3) The install procedure automatically adds a **NovaLogic** folder to your **Windows® 95/98 Start Menu** under the **Programs** heading. The **F-16** sub-folder within the NovaLogic folder contains an application short-cut icon for the game. The install also places an **F-16** shortcut icon on your desktop.

4) If your system does not already have DirectX installed, you will need to install it now. Select **Install DirectX** from the AutoRun program, then follow the on-screen instructions. You will need to restart your computer to activate DirectX before you can play **F-16 Multirole Fighter**.

### **3Dfx™ Users**

*If the game appears too bright or washed out in 3Dfx™ mode, we recommend that you check the Gamma control of your 3D fx™ card. You can do this by going to the Displays in your computer's Control Panel Settings under the Start Menu.*

## ***Calibrating the Joystick***

If you haven't done so already, you will need to calibrate your joystick in **Windows 95/98** for it to work properly in **F-16 Multirole Fighter**. Follow these steps:

1. Click on the **Start** button at the far left of the **Taskbar** at the bottom of the screen.
2. Highlight **Settings**, then select **Control Panel** from the menu.
3. Double-click on the **Game Controllers** icon.
4. Select your joystick from the list of game controllers you have installed, then follow the on-screen instructions to calibrate your joystick.

## ***Starting the Game***

If your computer is already turned on and the **F-16 Multirole Fighter** CD is in the CD-ROM drive, double-click on the **F-16 Multirole Fighter** shortcut, or go to the directory containing the simulation or Start Menu and double-click on the **F-16 Multirole Fighter** program icon.

If your computer is on, but the program CD is not in the drive, insert the **F-16 Multirole Fighter** CD into the drive and select **Start** from the AutoRun screen. If no screen appears when you insert the CD, double-click on the **"My Computer"** icon on your desktop, then double-click on the icon for your computer's CD-ROM drive. You can then choose **Start** from the AutoRun screen. You may also use your computer's **Find** feature to locate and launch the program.

Enjoy!

## Chapter 2

# Quick Start

For those of you who want to jump right into the simulation, select **Quick Mission** from the **Main Menu**. Click **Accept** to get to the **Mission Briefing** and **Accept** again to start the mission. Your F-16 will have an appropriate weapons load. To abort the mission, press the **[esc]** key. In order to utilize the number pad on your keyboard, you will want to make certain that the **[num lock]** is on.

Press the **[pause]** key if you need to pause the simulation between the steps listed below or at anytime.

## 10 Easy Steps to Getting Up In The Air



- 1) The mission will begin with the camera positioned on the exterior of your F-16. Press **[F1]** to enter the virtual cockpit. Press it again for an alternate view of the cockpit. Press **[F2]** if you prefer to use the F-16's HUD (Head-Up Display) view.
- 2) Hit the **[backspace]** to engage your afterburner. You will begin to accelerate down the runway. At around 160 knots (located in the box at the left side of the HUD), pull up into the air. This could take longer depending on your aircraft's total weight.
- 3) Press the **[G]** key to raise your landing gear only if you have changed your Landing Gear to **Manual** in the **Options** screen. Climb to a comfortable altitude (generally around 20,000 ft). The Altitude Above Sea Level (ASL) is in the right hand box of your HUD. Adjust the engine power with **[7]** **[8]** **[9]** **[0]** keys or pour on the speed with the **[backspace]** key (afterburners). Cut your afterburner to conserve fuel.
- 4) Now is the time to practice flying. Try making turns and rolls with your arrow key or joystick. If you are having trouble stabilizing, use the **[L]** to auto level the plane. With all aircraft maneuvers, you should try to be deliberate and precise.

5) Level out and take the time to look around your aircraft. This would be a good time to hit **[pause]**. The entire number pad (and hatswitch on some joysticks) allows you look about the cockpit. "Check your Six" (look behind you) by pressing the **[+]** on the number pad. Press **[F3]** to see the exterior of your aircraft. While holding the **[ctrl]** key down, you can move the camera angle with your arrow keys. Pressing the **[S]** and **[X]** keys will zoom the view in and out respectively.

6) Hit **[F2]** to check your HUD for your next Steerpoint (a preprogrammed navigational reference point), then proceed there. The tadpole in the middle of your HUD points to your next navigational Steerpoint. If you desire, you may press the **[A]** key and the autopilot will direct the F-16 there for you.

7) Hitting the **[R]** key will toggle your radar on and off. Radar is used to select a target.

8) Cycle through your weapons with the **[~]** key (or joystick button 3).

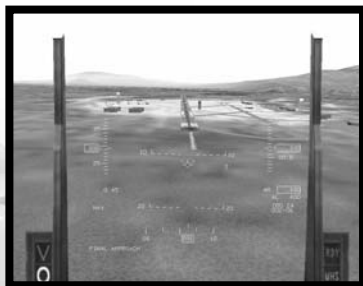
9) When you have your target acquired and are in range, press the **[spacebar]** (or joystick button 2) to launch or fire your weapon. At any time you can fire your 20 mm cannon by pressing the **[Z]** button (or joystick trigger).

10) Press the **[O]** key to view your mission objectives. After completing all of them, you will be prompted to end your mission. Do so by pressing the **[E]** key. You are not required to land your airplane to complete most missions, but will get a higher score if you do.

## ***10 Easy Steps to Getting Back on the Ground***

1) Press the **[H]** key to have the navigational computer guide you directly toward the Initial Approach Steerpoint (about 15 miles from the runway).

2) When you are facing the correct direction toward this Steerpoint, reduce the throttle to 60% by pressing **[8]**. Get to an altitude of 5000 feet AGL, with a speed of 400 knots. Use your air brakes (**[B]**), if you are going too fast.



- 3) When you get to the Initial Approach Steerpoint, begin reducing speed and altitude. When you hit the Final Approach Steerpoint (about 5 miles from the runway), you should be around 1500 feet AGL and flying no more than 250 knots.
- 4) Press **[G]** to lower your landing gear.
- 5) Align yourself with the center of the runway. Avoid sharp banks and sudden turns. Level your wings, use the **[L]** key as needed.
- 6) You should be flying at about 160 knots. Use your air brakes (**[B]**), if you are going more than 175 knots.
- 7) Check the HUD Pitch Scale. Adjust your pitch to be about 10 degrees.
- 8) Keep your aircraft aligned with the runway centerline. Use the Instrument Landing System, located on the center of the Head-Up Display. Align the vertical and horizontal lines.
- 9) Just before touchdown, "flare" (pitch) your aircraft's nose up.
- 10) Press the **[B]** key to apply brakes until the plane stops. Congratulations, you may now end the mission.

## Chapter 3

## The Menus

The F-16 Menu System gives you access to all game features, including campaigns, missions, multiplayer options, and information about the simulation itself. Each session of **F-16 Multirole Fighter** begins at the **Main Menu**, from which you can make the following selections by pressing the underlined key or using your mouse:



## Quick Mission

Select **Quick Mission** when you simply want to fly, without the long term considerations of a campaign. **F-16 Multirole Fighter** provides you with a set of missions designed especially for this feature. In addition, whenever you complete a mission in a campaign, that mission is added to

the Quick Mission list, so you will be able to select it for replay whenever you want.

To select a Training Mission or a Quick Mission, click on the **Quick Mission** option on the **Main Menu** then examine the list of missions provided. You can scroll through all the available missions with the scroll bars to the left of the mission title. Highlight a mission to get a description of the situation and goals. Click on the **Accept** box when you have highlighted the mission you wish to fly, or click on **Back** to return to the **Main Menu**. Press **User Created** to load in a custom mission created by the Mission Editor.

## Mission Briefing

When you are given a mission, either because you selected it from the **Quick Mission** list or because you have been assigned a task



as part of a continuing **Campaign**, the first element is always a **Mission Briefing**. The briefing details the tasks you must complete before the mission can be considered over. You are required to achieve all the mission's primary objectives before you are allowed to end the mission.

The **Mission Briefing** screen lets you determine some of the conditions under which you will fly the mission, including the ammunition loadout you will take into the air, the amount of fuel you will carry, and the Map route you will follow to accomplish your goals. Click on **Loadout** to view or change the mission default munitions and fuel aboard, and click on **Map** to check out the battle zone and set your flight route for this mission. Click on the **Accept** box to begin the simulation, or click on **Back** to return to the **Quick Mission** screen.

## Loadout

Click on **Loadout** to select what armaments your F-16 will carry for this mission. This brings up the **Loadout Options** screen. Here you will see your plane sitting in the hangar awaiting ordnance. As you load the F-16, the armament will be placed on the appropriate stations. You can use the center buttons or keyboard arrow keys to walk around or zoom toward the aircraft.



You select your ordnance on the lower left side of the screen. Each station is marked by a number that corresponds with the diagram of the plane. Use the arrow buttons to scroll through the possible armament for each station. The text box on the lower right will display important information about the ordnance selected.

The lower center column contains two options. The first one allows you to choose between **Normal Mode** and **Double Mode**. Normal Mode will limit your aircraft to an authentic Loadout maximum. The Double Mode will double your existing weaponry without adding the extra weight. Pressing the **Default Load** button will automatically load your F-16 with a balanced inventory recommended for this specific mission by the mission designers. If you are undertaking a **Campaign** mission, the number of weapons

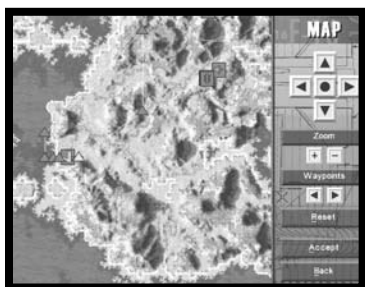


available is the total number you can have for the entire campaign, unless friendly transport aircraft or convoys bring in more. If the transports in a particular campaign get shot down, you may face ammunition shortages in that Campaign.

The lower right side displays important Loadout information, including the weight of your fuel and ordnance. In Normal Mode, you will not be able to exceed the maximum weight allowance of the F-16 (37,203 pounds).

***The heavier your aircraft is, the longer it will take to achieve liftoff. Also with increased drag, your in-air maneuverability will be diminished. However, remember that as you expend fuel by flying, your aircraft will start to become lighter.***

When you have finished, click on **Accept** to give yourself the weapons load you have selected and return to the **Mission Briefing**. Click on **Back** to return to the Mission Briefing screen without choosing a Loadout.



## Map

Every mission begins with a series of **Steerpoints** already entered on the map. Steerpoints are locations that your on-board navigational computer can use to give directions to your Autopilot. They are also handy for manual navigation. Your HUD (Head-Up Display) in the front

of the cockpit will direct you toward any selected Steerpoint. This simplifies navigation enormously, particularly under conditions where you find it difficult to locate landmarks below, such as at night.

You can move most of the Steerpoints on the map, changing the designated mission route. Simply click on a Steerpoint and hold the mouse button down while you drag the icon to a new location. Release the mouse button to place the Steerpoint in its new location. You will not be able to move the last two Steerpoints. These are your **Initial** and **Final Approach** Steerpoints, which help you land your airplane. Click on the **Steerpoint** buttons to select the next or previous Steerpoint. Use the arrow buttons at the right to scroll the map, and click on the **Zoom** buttons to zoom the map in and out. You can instantly return to the mission default Steerpoints settings by pressing the **Default** button.

When you have thoroughly examined the terrain over which you will be flying, and have arranged the mission Steerpoints to your satisfaction, click on **Accept** to save your choices and return to the **Mission Briefing** screen. Clicking on **Back** will return to the **Mission Briefing** screen without saving your changes.

## ***Ending a Mission***

If you run low of ammunition or fuel on a mission, you may return to your base to pick up more. You will have to land at your base and bring the aircraft to a complete stop before you can be rearmed and refueled. Damage to the aircraft, however, will not be repaired while you are still on this mission.

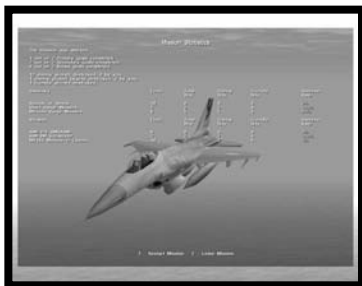
You must complete all your assigned primary mission objectives before your mission can be considered a success. If, for example, your **Mission Briefing** orders you to shoot down a transport, eliminate its escorting fighters, and bomb its base, and you shoot down the transport and a few fighters, you will still have to accomplish the rest of your mission goals to have a successful mission. During a mission, press the **[M]** key to view the list of mission objectives. To get credit for a completed mission you will have to achieve all your primary mission goals. Secondary and bonus goals are only recommended, not required to succeed.

When you complete all the assigned primary goals in a mission, you will receive a text message across the top of your screen, giving you clearance to end the mission by pressing the **[E]** key. This will bring up the **Mission Statistics Screen**, which analyzes your mission performance. In all missions you will receive a score, so you will know how well you did on the flight. To get the most points possible for a mission, do not press the **[E]** key as soon as you have accomplished the mission goals. Wait until you have taken your aircraft back to base and landed it before pressing **[E]**. That way you will receive the **Landing Bonus**, a large addition to your score, awarded once each mission for successfully landing the aircraft back at base.

***You may abort any mission at any time by pressing the **[ESC]** key. When you abort a mission you will be taken directly to the Mission Statistics screen.***

## The Mission Statistics Screen

At the conclusion of each mission you get a summary of your performance, including how many enemy aircraft and ground targets you destroyed and how many missiles, bombs, or cannon rounds it took you to do so. You will be rated for accuracy as well. There will also be a **Mission Score** assigned. If you are playing a **Quick Mission** this score is for your own information, but in **Campaign** missions this score constitutes your **Promotion Points** for the mission, which are essential to achieve higher rank. Press **[1]** if you wish to replay the scenario. Press **[ESC]** or **[2]** to exit to the **Mission Briefing** screen for your next assignment.



## Scoring

You receive points during a mission based on whether or not you accomplish certain tasks. Here are the tasks for which you can receive points:

- **Complete a Mission**—1,000 points, once per mission
- **Bonus for Wingman Surviving**—1000, once per mission
- **Achieve Mission Bonus Goal**—500 points per goal
- **Successful Landing**—500 points, once per mission
- **Cannon Success Rate**—10 points per 1% efficiency
- **Short Range Missile Success Rate**—5 points per 1% efficiency
- **Medium Range Missile Success Rate**—5 points per 1% efficiency
- **Bomb Success Rate**—8 points per 1 % efficiency
- **Airframe Integrity**—5 points per 1% undamaged structure at missions end
- **Killed Enemy Skill Level Bonus**—0-250 points depending on enemy pilot's skill level

## Campaigns

Choose **Campaigns** to start a new campaign game with a new pilot or continue a campaign in progress with an established pilot. You can have up to ten pilots/campaigns at one time. Use the



mouse to select the slot with the call sign of the pilot who will be flying your campaign and press **enter**.

If you wish to edit a pilot's call sign, highlight it, then click on **Edit Name**. You will be able to enter a new call sign for your pilot. To remove a pilot from the list and free up a campaign slot, highlight your pilot's call

sign and then click on **Delete Slot**. This will permanently remove that pilot's career from your system. A warning screen will appear to ensure that you wish to complete this action.

On the right side of the screen is the **Pilot Stats**, where you can view your overall performance ratings and score. Press the arrows to see the **Pilot Awards** you have accumulated. The game rewards successful completion of all the missions in a single campaign with a Medal. The Air Force recognizes your hard work and accomplishments; wear your medals with pride. Pressing the arrows again will bring you to the **Campaign Stats**, where you can select which campaign to play. Feel free to switch to a new campaign at any time.

When you have selected a pilot for your campaign, click on the **Accept** box to continue, or click on **Back** to return to the **Main Menu**. When you accept a campaign you will go directly to the **Mission Briefing** screen for the first mission in your campaign. See the **Mission Briefing** section under **Quick Mission** at the beginning of this chapter for a complete description.

## The Campaigns

**F-16 Multirole Fighter** consists of five separate Campaigns which you can play in any order. Campaigns are made up of a series of missions linked to a common story line. Actions taken in one mission affect some of the conditions for the next. The goals for subsequent missions can be changed by your success (or lack thereof) in an earlier one. If, for example, you bomb a factory in one mission, it will still be destroyed when you fly over it on your next

mission. Similarly, if you allow enemy fighters to destroy your AWACS plane, it will not be available for the remainder of that campaign unless another one is sent in. When you are conducting a campaign, you do not select your own missions. F-16 will assign missions based on what you have achieved so far in the campaign, and on what the overall campaign requires.

You may also have restricted Loadout choices. Each campaign allows your unit only a certain number of bombs and guided missiles, though supplies may be replenished by friendly transports. You must therefore pay attention to some of the logistical factors in a campaign. If you shoot a lot of AMRAAM radar-guided missiles, for example, you may run out of them, leaving you only Sidewinders and your 20mm cannon to combat enemy aircraft until new missiles can be flown in.

### ***Serbia***

An extremist Serb faction within the Yugoslav military has seized control of the Yugoslavian government. Blaming the continued economic hardships of the country on international interference and loss of territories that are rightfully Serbian, this faction has begun making territorial and economic demands on its neighbors. Concerned that this will upset the fragile balance of the region, the United Nations and NATO have authorized a limited operation to defeat the extremists and restore the legitimate Yugoslavian government.

### ***Liberia / Sierra Leone***

After the death of their president, the military government of Nigeria appointed a hard-line general to lead the country. Once in power this general initiated a large scale modernization of his armed forces, including procurement of new weapon systems from China. Unable to raise money because of an international embargo on Nigerian oil, the general ordered his forces to seize control of the extensive diamond fields in Sierra Leone. Buoyed by their quick success in Sierra Leone, Nigerian forces have been ordered to continue their blitzkrieg and attack Liberia. Alarmed at the quick capitulation of the government in neighboring Sierra Leone, Liberia has appealed to their long time friend the United States for assistance. The UN Security Council has authorized a US led mission to protect Liberia from this aggression and to restore the rightful government of Sierra Leone.

### ***Democratic Republic of the Congo***

After months of fighting in the Democratic Republic of the Congo (DRC), government forces were on the brink of defeating rebel forces. The DRC had long claimed that Rwandan military units

were fighting alongside the rebels, but could not obtain proof that the war was being orchestrated by its neighbor. As DRC government forces closed in on the last positions of the rebels, the Rwandan military poured across the border. The surprise attack stunned the DRC military and forced them to retreat significantly. With Rwandan forces openly attacking DRC positions, the President of the DRC has requested assistance in ending the long conflict and driving back the invaders within its territory. With the leadership of the United States, the UN Security Council has authorized the creation of a force sufficient to push back the Rwandans and secure the territorial integrity of the DRC.

### ***Burma (Myanmar)***

The most powerful drug lord of the Golden Triangle has been steadily increasing the strength of his personal army. Through careful diplomacy and big promises he managed to unite most of the armies opposing the national government. In a series of well-executed battles, the unified armies defeated the State Law and Order Restoration Council (SLORC) and gained control of the entire country. By holding the majority of his own troops in reserve, the drug lord maintained his own strength while weakening the strength of his "allies". Once in power, he commanded his army to destroy all of his former allies and grabbed control over all of Burma. His goal is to use this vast military to take over all Opium production in the region. This includes seizing areas of Thailand, Laos, and even China.

Fearful of the instability being wrought by these actions, the Association of South-East Asian Nations (ASEAN) and the UN have sanctioned a multi-lateral force to defeat this threat. US forces and leadership will be the key to coordinating this force and defeating this large and highly motivated drug lord's army.

### ***Somalia/Ethiopia***

After years of internecine fighting between the various warlords and their clans in Somalia, the Somaliland National Front (SNF) managed to defeat its rivals and unify the country. While the international community was happy to see the long years of bloody struggle end, many voiced suspicions about the number and types of weapons used by the SNF. Upon the full pacification of northern Somalia, the SNF began exploitation of the natural gas and oil deposits discovered by the UN during operations there in the early 1990s. When the deposits were discovered to be very limited, the SNF started to make claims on the known oil reserves in Ethiopia.

Following a swift build-up in its military capability, the SNF has

crossed into Ethiopian territory. The international community was quick to condemn this brutal invasion. In cooperation with the member states of the Organization of African Unity, the United States has dispatched its forces to roll back this invasion.

## Multiplayer

**F-16 Multirole Fighter** allows for the exciting possibility of fighting against up to 128 opponents on NovaWorld and the challenge of facing the MiG-29 Fulcrum™ and F-22 Raptor™ in **Integrated Battle Space**. See **Chapter 9: Multiplayer** for more details.

## Options

The **Options** selection lets you to choose a variety of game-related parameters, allowing you to set up the game for best performance on your system. It also gives you options concerning some of the features you can include in an F-16 game. Access the configuration features via the **Options** choice on the **Main Menu**. Press **Accept** to accept changes and return to the **Main Menu** screen.

## Video Options

### Game Fullscreen

Select **No** from the **Game Fullscreen** option to run the game inside a **Windows** window. Selecting **Yes** gives you a full-screen view of the simulation. When you are playing the simulation you may also toggle between the choices by pressing both **ctrl** + **V**.



### Game Resolution

Choose the screen resolution that is most suitable for your computer. The options are **640 x 480**, **800 x 600**, and **1024 x 768**. The higher the resolution, the finer the graphical detail will be, however the game will play slower.

### 3D Card

Select **Enabled** if you wish to use your 3D card to enhance the graphical representation of the simulator. If your system does not have a suitable 3D card or lacks the appropriate drivers, then only the **Disabled** option will be available. Select the **Video Information** button below to see the specific set up of your system.

## Menus Fullscreen

Select **No** to display the pre-game menus inside a **Windows** window. Selecting **Yes** gives you a full-screen view of the menus. Depending on your system, you may need to have this option enabled to connect to NovaWorld.

## Video Information

Pressing the question mark will have **F-16 Multirole Fighter** auto-detect your systems configuration.

## Audio Options



### Sound FX Volume

Use the mouse to slide the bar to an appropriate volume level for game sounds.

### Music Volume

Use the mouse to slide the bar to an appropriate volume level for the menu music.

## Menu Music

**Disabling** this option will override the **Music Volume** control and turn the menu music off.

## Avionic Sound Cues

Select **Enable** to hear indicator tones and beeps given off by your F-16's computer.

## Voice Dialog Volume

Use the mouse to slide the bar to an appropriate volume level for game dialog.

## Control/Performance Options

### Joystick

When you select **Enabled**, your joystick will be the primary flight control device for the simulation. If you select **Disabled**, the keyboard's arrow keys are the only way to fly the F-16.





## Joystick Type

This option provides you with a list of joystick types to choose from. Select the one that matches your joystick. If your joystick brand is not listed, use the **Standard** option.



## Throttle Controller

Allows you to select an external throttle device. Your choices are **Yes**, **No**, and **Reverse**. Selecting **Reverse** means that your external throttle will accelerate the airplane when you pull back on the throttle yoke rather than when you push it forward. Note that you cannot use an external throttle to start the engines. You will have to press one of the **Engine Control** keys to start them.

## Rudder Pedals

Your choices are **Yes** and **No**. Select **Yes** if you have a set of external Rudder Pedals or twisting joystick connected.

## Ground Steering

This selection lets you determine what method of steering control you use when on the ground. Your selections are **Stick** or **Rudder Pedals**. Selecting **Stick** means that the joystick (or the arrow keys if you have no joystick installed) steers the aircraft while it is on the runway. Select **Rudder Pedals** if you want to steer the aircraft with rudder pedals or the rudder keys  and . In this mode, the arrow keys will not affect ground steering.

## Texture Distance

This slide controller allows you to set the distance at which the F-16 simulation will apply textures to the terrain. Players with slower machines should move the slider to the left to speed up the graphical presentation.

## Memory Usage

Your choices are **High**, **Medium**, and **Low**. Select **High** if your system is well equipped with RAM. Select **Low** if you have a small amount of RAM.

## Flight Model Options


### Blackouts / Redouts

Sharp turns and rapid acceleration can cause severe G-force consequences to an aircraft's pilot. High-G turns, for example, cause



blood to drain from the pilot's head, leading to blackouts. Similarly, maneuvers that bring about negative-G situations can cause the body's blood supply to rush to the head, filling the eyes with blood and causing a redout. If you do not want this degree of realism in an F-16 mission, turn this selection to **Off** before you fly.

## ***Shoot List***

**Auto** creates a shootlist whenever you have targets available. If you select **Manual**, you will have to press the  key to have your aircraft create a shootlist.

## ***Joystick Mapping***

Your joystick's **Cannon Priority** configuration is described in **Chapter 4: Joystick Buttons**. Select **Weapons Priority** to shift all of the buttons down one so that the Trigger will now fire your currently selected weapon. In this configuration, hold down button 4 to move the camera angle around. The Weapon Priority configuration is generally preferred for 2-button joysticks.

## ***Landing Gear Up***

Select **Auto** to have your F-16 automatically raise its landing gear after takeoff and lower them when you slow to fewer than 250 knots while landing. **Manual** means you perform this task yourself.

## ***Unbalanced Loadouts***

If you select **Enabled**, your plane will list/roll when your loadouts are unbalanced by firing ordnance from only one wing. With this feature set to **Disabled**, your plane's balance is not affected by unbalanced loadouts.

## ***Flameouts***

In certain circumstances, the engine of the F-16 can lose all power in a flameout. The engine will try to re-ignite itself, but may not be successful. Select **Enabled** if you want this level of authenticity. Choosing **Disabled** will not allow the F-16 to experience flameouts.

## ***Flatspins***

In rare cases, a wrong maneuver can throw the aircraft into the dangerous flatspin. Recovering from this predicament is nearly impossible. Select **Enabled** if you want this level of authenticity. Choosing **Disabled** will not allow the F-16 to experience flatspins.

## Map Keyboard and Joystick

You have the ability to alter any of the Keyboard commands and Joystick buttons to suit your tastes. Using the mouse, click on the command that you would like to change. Type the key or push the button that you would like to be used for that command, when the **Status** bar indicates that input is on for that command. If the message in the Status bar indicates that "Input is off", then nothing will be changed if you hit a key or button. The Status bar will also indicate if there is a conflict with another command sharing the same key.



Use the left-hand scroll bar to see all possible Keyboard and Joystick commands. Select the **Revert All** button to change all keys or buttons back to your last saved configuration. Pressing the **Default All** button will change all of the keys or buttons back to the original configuration set by NovaLogic. Under this is a **Default** button to reset only the selected command back to the original configuration and a **Delete** button to remove all keys or buttons associated with the corresponding command. This is useful in avoiding conflicts.

## Overview

This section highlights key points of the **F-16 Multirole Fighter**.

## Credits

Make this selection to learn more about the people who created the **F-16 Multirole Fighter** simulation.

## Exit

Choosing **Exit** takes you directly back to the **Windows** operating system desktop.



## Chapter 4

# Controls

## The Joystick

All game controls can be found on the keyboard, however the preferred flight control device for the **F-16 Multirole Fighter** simulator is the joystick. With a little practice, using the joystick will help immerse you into the aircraft's cockpit. When flying, try to make your stick movements definite and purposeful. A good pilot is always in positive control of the aircraft.

## The Stick

The stick controls the elevators, at the rear of the aircraft, and the flaperons, on the trailing edges of the wings. The elevators pitch the nose of the aircraft up or down, while the flaperons roll the airplane around its longitudinal axis. Combining these two elements allows you to turn.

When you move the joystick to the left or right, it causes the wings of your aircraft to bank in the direction of the stick movement. If you move the stick to the right, for example, the flaperons cause the right wing of the aircraft to drop and the left wing to rise. The airplane is now "banked" to the right. Now when you pull back on the joystick the elevators will pitch the nose of the plane up perpendicular to the wings, and cause the aircraft to turn in the direction of the bank. The further you push the stick to the right or left, and the harder you pull it back, the faster your turn will be.

Sharp turns increase the G forces exerted on the aircraft, which may cause it to lose both airspeed and altitude or begin to shake as its airframe becomes compromised. High G stresses can also cause the pilot to become unconscious. Save your extreme maneuvers for times you really need them, like when you are trying to dodge a missile or get behind an enemy aircraft.

## Joystick Buttons

**F-16** supports joysticks with up to sixteen buttons, and includes a number of custom joystick configuration files. You can reconfigure the joystick buttons in the **Options** screen.

The Cannon Priority Default configuration for the joystick buttons is as follows:

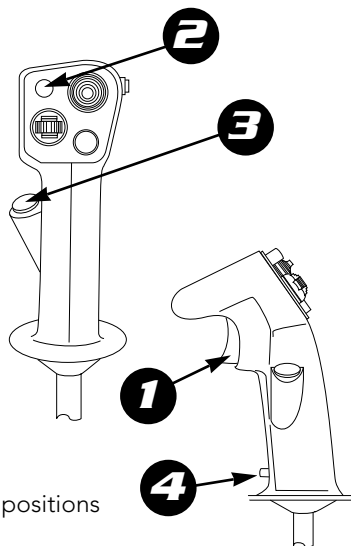
- **Button 1**—The **Trigger** button fires several rounds from your 20mm cannon.
- **Button 2**— Fires or launches your selected weapon.
- **Button 3**— Cycles through all the targets on your Shootlist.
- **Button 4**— Cycles through your available weapons.
- **Hat Switch**—The four hat switch positions perform the following functions:

**Up**—The Up position toggles between the Virtual Cockpit view and the HUD.

**Down**—Push the hat switch button to the Down position to look to your rear (“check your six”).

**Left**—Look out the cockpit to the left.

**Right**—Look out the cockpit to the right.



**Use the Options screen to select your specific joystick type or reconfigure the joystick buttons.**

## Rudder Controls

The rudders cause the airplane’s nose to swing to the left or right (this motion is called “yaw”). Modern aircraft integrate the rudder into the operation of the joystick, automatically applying the proper amount of rudder to enhance the operations of the flaperons.

You can use rudder inputs to make your flight maneuvers more extreme, which can be useful in combat. Use the rudder to exaggerate your other control motions. Step on the right rudder, for example, when you are making a right-hand turn with the joystick. The actions of the rudders will bring the nose of the aircraft around more quickly than the effect of the flaperons and elevators alone. You can also use the rudders to make flight inputs in the opposite direction from your other controls. If you can control the instability of the flight path, it will make it difficult for an enemy to stay with you.

## Throttle Controls

To better simulate the F-16, you have the option of attaching an external throttle controller. Pushing the throttle forward will increase the engine's thrust. Moving the throttle all the way forward equates to using full afterburners. In the **Options** screen, you can reverse the direction of the throttle device.

## Keyboard Controls

**F-16 Multirole Fighter** uses the keyboard to control many of the on-board systems in the airplane, and to control a wide variety of camera views. The keyboard also gives you alternate methods of exercising flight control, and provides a means of communicating with your wingman. In addition, you use the keyboard for game functions not specifically related to flying the F-16.

## General Game Controls

These keys control aspects of the game not directly concerned with the flight of the aircraft or the operation of its weapons and other on-board systems.

**[esc] Exit Mission**—Press the **Escape** key to abort your current mission. You will have the option to change your mind before the mission aborts.

**[pause] Pause**—Use this key as a toggle to halt/resume the current mission. This key does not function in multiplayer games.

**[ctrl] Reverse Cycle**—Used in combination with some other keys, **Control** will reverse the direction of a cycling list. For example, if you press **Control** with **Tab**, you will cycle through your targets in the reverse order.

**[?] Keyboard Help**—Use the **Question Mark** key to bring up an on-screen key control summary. Press **?** again to remove the list from the screen.

**[O] Mission Objectives**—Press **O** to toggle a list of your mission goals and their status.

**[Y] Recent Messages**—Keeps a list of the most recent dialog from the computer and other players.

**[ctrl] [V] Window/Full Screen**—Use this key combination to toggle your screen mode from **Full Screen** to **Windowed** and back.

**[E] End Mission**—Press the **E** key to end the current mission and receive an evaluation of the mission's success or failure. You can only use this key when you have completed all the primary objectives in your current mission or when you have failed a mission.

## Keypad Views

F-16 provides an extensive series of perspectives from which to operate or view the simulation. Use the various points of view offered to increase your situational awareness. If there is one single rule for success in fighter aircraft, it is, "keep your head moving." You must always be looking around for threats and opportunities.

With the exception of **keypad 8**, the below views are static. You cannot pan, tilt, or zoom the image. When in one of the above perspectives, pressing the key a second time will return you to the screen from which you entered the view. You must have **Number Lock** on in order to utilize the keypad on the side of your keyboard.

**Keypad [1] Left Auxiliary Console**—Press this key to look down at your left auxiliary console.

**Keypad [2] Look Down**—Press this key to look down at the lower center gauges.

**Keypad [3] Right Auxiliary Console**—Press this key to look down at your right auxiliary console.

**Keypad [4] Left MFD**—Press this key to quickly zoom into the left hand MFD.

**Keypad [5] Center Console**—Press this key to view the center controls such as your Airspeed Indicator and Altimeter.

**Keypad [6] Right MFD**—Press this key to quickly zoom into the right hand MFD.

**Keypad [7] Threat Warning Indicator**—Press this key to look at the upper left side of the cockpit.


**Keypad [8] Virtual Cockpit**—Press this key to view the entire virtual cockpit. Using Control and arrow keys will shift the perspective from here.

**Keypad [9] Attitude Indicator**—Press this key to look at the upper right side of the cockpit.

**Keypad [/] Look Left**—Press the **slash** key to look out the left side of your aircraft's cockpit.


**Keypad [\*] Look Right**—Press the **asterisk** key to look out the right side of the cockpit.

**Keypad [-] Look Forward**—Press the **minus** key on the keypad to look straight ahead out of the cockpit.


**Keypad  Check Six**—Press the keypad **plus** key to quickly look behind you. Use this key often.

## ***Camera Controls***



You can control the position of the camera while in the virtual cockpit view and external camera view.



** Zoom In Slow**—Press this key to magnify your camera view or display range and zoom in on the object you are viewing.



**  Zoom In Fast**—As above, but faster.



** Zoom Out Slow**—Press this key to expand your camera view or display range and zoom your perspective out.

**  Zoom Out Fast**—As above, rapidly.

**  Tilt Up**—Pressing the up arrow while holding down on the control key will move the perspective up.


**  Tilt Down**— Moves the camera perspective down.


**  Pan Right**—Moves the camera perspective to the right.


**  Pan Left**— Moves the camera perspective to the left.


## ***Perspectives Controls***


The Function Keys will control the various camera views in **F-16 Multirole Fighter**.

** Virtual Cockpit View**—Press the **F1** key to place yourself in the cockpit, looking forward through the Head-Up Display. Press again to zoom closer to the HUD. This is the most common perspective from which to operate the F-16.

** HUD View**—Pressing the **F2** key puts you in a perspective similar to that available via the **F1**, but removes the cockpit frame from the screen, giving you a little better view of the terrain outside your aircraft.

** External View**—Press the **F3** key to show an external view of your aircraft. You can move or zoom the camera perspective. Press again to see alternate external views. See the **Camera Controls** section for how to change the camera point of view.

** Fly-By View**—Pressing the **F4** key puts you at a fixed point outside your aircraft, watching it fly past your location.

** Target Padlock View**—If you have a target designated, pressing the **F5** key will keep the target centered in your field of vision, regardless of where it moves.



- [F6] Wingman External View**—Brings up an external view of your wingman's plane. This view is movable.
- [F7] Missile Toggle**—Press this key to watch your missile fly past a fixed location. Press the **F7** key again to get a movable external camera view of your missile. The **F7** key now toggles you between these two perspectives.
- [F8] Target View**—Press this key to access a movable external camera view of your current target.
- [F9] LANTIRN On/Off**—Toggle your LANTIRN system on and off with this key.
- [F10] HUD On/Off**—Toggle your Head-Up Display on and off with this key.
- [F11] Attack Display**—Toggle an overlay view of your Situational Awareness Mode on and off with this key.
- [F12] Time Compression**—The F-16 simulation allows you to “speed up” the passage of time by using the **F12** key. Moving the aircraft or pressing this key again will return back to normal speed. This key does not function during multiplayer games.

## ***Engine Power Settings***

The throttle controls regulate the amount of thrust being produced by your engine. Higher power settings increase your thrust, but they also increase fuel consumption alarmingly. Keep your eye on the amount of fuel you have remaining. Use the number keys at the top of the keyboard to control the engine.

- [6] 0% Power; Engine Off**—Press this key to shut down your engine.
- [7] 35% Power; Taxi**—Press the **7** key to turn your engine on and idle. If on the ground, you will begin taxiing.
- [8] 60% Power; Landing**—Press this key to bring your engine to the suggested amount of thrust for landing.
- [9] 70% Power; Cruise**—Press this key to set your engine output to 70% for normal flying.
- [0] 100% Power; Full Military Power**—The **zero** key on the keyboard puts your engine power to 100%, useful for most combat engagements.
- [–] Decrease Thrust**—Pressing the **minus** key decreases your engine power in small increments.

**[=] Increase Thrust**—Pressing the **equals** key increases engine power slightly each time you press it.

**[backspace] Afterburner**—Press the keyboard's **Back Space** key to engage your afterburner. Using the afterburner gives you a large boost in engine power, but uses fuel at an astonishing rate.

## General Flight Controls

The following keys control flight operations and some of the airframe systems aboard the F-16. Some of these keys duplicate the functions of other flight control devices, such as a joystick or rudder pedals.

**[↑] Pitch Down**—Press this key to pitch the nose of your aircraft downwards.

**[↓] Pitch Up**—Press the **Down Arrow** key to pitch the nose of your aircraft upwards.

**[←] Roll Left**—Press this key to bank your wings and roll the aircraft to the left.

**[→] Roll Right**—Use the **Right Arrow** key to bank to the right.

**[page down] Right Rudder**—Press this key to yaw the nose of your aircraft to the right.




**[delete] Left Rudder**—Yaws the nose of your aircraft to the left.

**[G] Gear Up/Down**—The **G** key raises and lowers your landing gear. A small “G” appears at the lower right of the screen when the gear is down. The landing gear will automatically raise when your airspeed goes over 250 knots and lowers when you approach the landing field below 250 knots.

**[B] Air and Ground Brakes**—Press the **B** key when in flight to extend the F-16's air brakes. On the ground, pressing **B** engages the craft's wheel brakes, allowing you to come to a stop. A small “B” appears at the lower right of the screen when you apply air or wheel brakes. The brakes will disengage when you release the key.





**[ctrl] [B] Brakes Toggle**—Press **B** and the **Control** key at the same time to toggle brakes on and off. The brakes will remain engaged until you press these keys again.

**[F] Flaps Up/Down**—To slowly bleed off speed and increase lift, use the **F** key to move your aircraft's flaps. A small “F” appears at the lower right of the screen when you have your flaps extended.

-  **Eject**—Use this key combination to exit a stricken airplane. Ejection from an aircraft in the inverted flight position at very low altitudes may be fatal.
-  **HUD Dim**— This key decreases the contrast/brightness of your HUD display.
-  **HUD Bright**— This key increases the contrast/brightness of the HUD display.







## ***Navigation Controls***

These keys control some of the navigational capabilities of the F-16, mainly to allow hands-off flight control and allow you to get back to base quickly and easily.

-  **Autopilot**—Use this key to engage your Autopilot. When engaged, the autopilot will take your aircraft automatically to the next selected Steerpoint. Exercising any of the manual flight controls, or pressing the **A** key again, will disengage the autopilot.
-  **Cycle Steerpoint**—Press the **N** key to cycle through your mission's Steerpoints. When you engage the Autopilot, it will automatically head for the next selected Steerpoint.
-  **Auto-Level**—Pressing the **L** key will immediately put your F-16 in straight and level flight.
-  **Home**—Pressing the **H** key engages the Autopilot to take you to the initial approach point of your home runway.

## ***Weapon Controls***

The following keys allow you to select weapons and countermeasures aboard your F-16. You will quickly become very familiar with these controls, or you will be dead. Use the keyboard (not the keypad) number keys to control the appropriate functions.

-  **Cycle Weapons**—Press the **Tilde** key to cycle through your available ordnance.
-  **Nav**—Press this key to deselect all weapons.
-  **Cannon**—Press this key to ready the M61A1 20mm cannon. This mode toggles between the EEGS and Strafing HUD mode
-  **Air to Air Missiles**—This key cycles through all of your available Sidewinders and AMRAAMs.
-  **Air to Ground Missiles**—Press this key to cycle through all of your available Air to Surface Missiles.
-  **Bombs**—Press this key to cycle through all of your bombs.

**[spacebar] Fire Selected Weapon**—Press the **Space Bar** to fire or drop the selected weapon or fuel pod.

**[Z] Fire Cannon**—Press the **Z** key to fire your 20 mm cannon. Note this will not bring up the Enhanced Envelope Gun Sight (EEGS) on your HUD.

**[C] Chaff**—Press this key to release a bundle of chaff to throw off an enemy missile's radar lock.

**[D] Flares**—Press the **D** key to deploy a series of flares to confuse an enemy heat-seeking missile.

**[ctrl] [J] Jettison Stores**—Press these keys to immediately drop all ordnance and fuel pods with the exception of Air to Air Missiles. This emergency only technique will drastically lessen your aircraft's weight in just a few seconds to give you additional speed and maneuverability. All weapons will jettison unarmed.

**[ctrl] [K] Jettison Current**—This key combination will jettison only the currently selected ordnance.

## Radar Controls

Your radar is instrumental in tracking targets for many of your weapon systems.

**[R] Radar On/Off**—Use this key to toggle your APG-68 radar from **Standby** to **On** and back. A small "R" will appear at the lower right of the screen when you have the radar turned on.

**[ctrl] [R] Cycle Radar**—This key combination will cycle through your various radar modes.











**[enter] Build Shootlist**—If you have disabled the Auto Shootlist in the **Options**, you will need to press this key to create a list of available targets.

**[tab] Cycle Targets**—Press this key to cycle through all detected objects that are in the forward arc of your aircraft and less than 40 nautical miles away.

**[L] Select Previous Target**—Use the **Left Bracket** key to cycle backwards through the targets currently on your shootlist.












**[J] Select Next Target**—Press the **Right Bracket** key to cycle forward through the targets currently on your shootlist. Joystick button # 3 will do the same thing.

**['] Boresight**—Press the **Single Quote** key to target the nearest object directly ahead of your aircraft.

-  **Cycle Left MFD**—This key is used to cycle your left Multifunction Display through all of its possible modes.
-  **Cycle Right MFD**—Press this key to cycle your right MFD through all of its possible modes.
-  **Laser Designator On/Off**—Use this key to toggle your laser guided bombs targeting designator on and off. A small “L” will appear in the lower right of the screen when you have the Laser Designator active.
-  **Park LANTIRN Targeting**—Use this key combination to reorient your LANTIRN's laser designator to the center of the HUD.
-   **LANTIRN Field of View**—Press this key to toggle the size of the LANTIRN cone.
-  **LANTIRN Lock**—Press this key when you want to lock the LANTIRN view on an arbitrary spot on the ground. As you fly away, the LANTIRN will attempt to continue to target this area.
-   **LANTIRN Slave**—Use the **End** key when you have a radar fix on a preprogrammed ground target. As you fly away, the LANTIRN will try to maintain that lock.
-  **Tactical Map**—This full screen grid map is highly useful in Multiplayer games. Use the grid coordinates to communicate your location to teammates.

## Wingman Controls

These keys allow you some control over the actions of your Wingman. Your flight companion has a large degree of freedom when it comes to carrying out these directives.

-  **Wingman Command Menu**—Brings up a list of commands you can give your Wingman.
-   **Wingman Cover**—Pressing the Ctrl **zero** key combination directs your wingman to form up on your right wing. Your wingman will maintain this formation until ordered otherwise.
-   **Evasive Maneuvers**—Directs your wingman to maneuver to avoid incoming missiles.
-   **Wingman Engage**—Press these keys to order your wingman to engage targets at will.
-   **Wingman Attack My Target**—Your wingman will immediately engage the target you have locked on radar.
-   **Break Right and Engage**—Orders your wingman to make a sharp turn to the right and engage at will.

- ctrl** **5** **Break Left and Engage**—As above, but to the left.
- ctrl** **6** **Engage My Target's Attacker**—If you have a friendly aircraft locked into your targeting system you can use this command to order your wingman to engage any enemy aircraft that attempts to attack the friendly.
- ctrl** **7** **Escort My Target**—Again, if you have a friendly aircraft in your targeting system, you can order your wingman to accompany that friendly aircraft and guard it from attack.
- ctrl** **8** **Cover Me**—Directs your wingman to engage any hostile aircraft with a radar lock on your aircraft.
- ctrl** **9** **Wingman Patrol Home Base**—Press these keys to order your wingman to return to your home base. Once there, your wingman will begin a Combat Air Patrol, keeping enemy aircraft away from your base.

## Multiplayer Keys

The following keys only have value in Multiplayer games.

- T** **Chat Mode**—Press the **T** key to send a text message to everybody in the game.
- shift** **T** **Squadron Chat**—Press the **Shift** and **T** keys together to send a private message to your squadron only.
- P** **Player List**—Lists all players currently in the game.
- Q** **Show Squadron**—Lists all members of your squadron who are currently playing in your game.
- ;** **Top 8 Players**—Use this key to see which players are leading the game.

## Mouse Controls

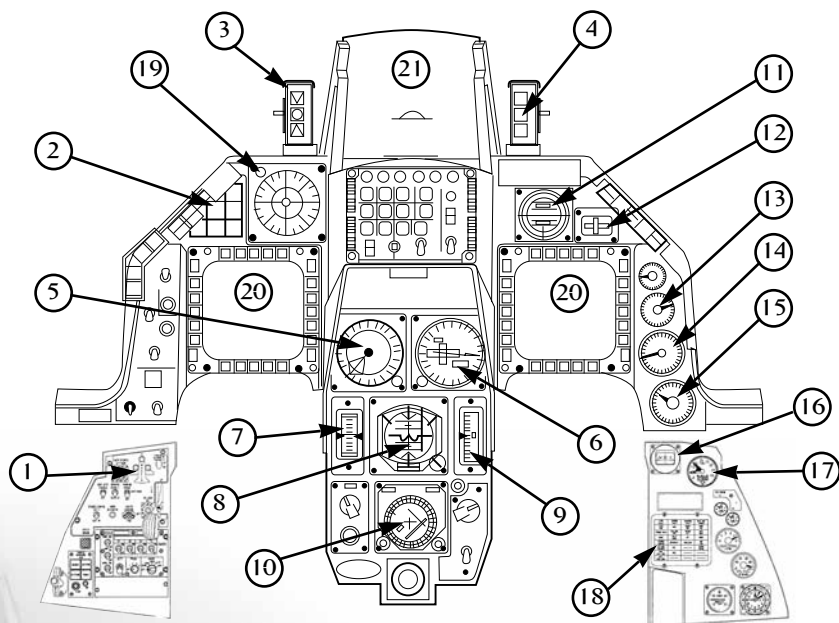
The Virtual Cockpit of the F-16 contains many buttons on the Multifunction Displays that can be activated by the mouse. Additionally, there are several areas where clicking the mouse will zoom the camera in closer to sections of the cockpit. The mouse icon will change shape when it encounters any of these hot spots.

## Chapter 5

# Displays

## The Cockpit Instruments

Your cockpit contains a wealth of information to help you fly the F-16. You should familiarize yourself with the various functions and their use



- 1) **Wheels down lights**—When your landing gear is down and locked these lights will be green.
- 2) **Launch Warning**—This will light up when an incoming missile is detected.
- 3) **AOA Indexer**—Primarily used for landing, the down arrow will light when you are going too slow with a high angle of attack. The up arrow indicates that you are going too fast with a low angle of attack.
- 4) **NWS Status**—The center light is active during taxiing, when your nose wheel controls steering instead of your flaperons and rudders.

- 
- 5) **Airspeed/Mach Indicator**—The outer ring measures your airspeed in nautical miles per hour. The inset needle shows your Mach.
  - 6) **Barometric Altimeter** —measured in feet ASL (Above Sea Level). The lower right-hand box denotes barometric pressure in inches of mercury.
  - 7) **AOA Indicator**—measured in degrees.
  - 8) **Attitude Director Indicator**—displays the pitch and roll of the aircraft.
  - 9) **VVI**—Vertical Velocity measured in thousands of feet per minute.
  - 10) **Horizontal Situation Indicator**—displays horizontal view of the aircraft and direction to next Steerpoint. The upper left box show the distance to the next Steerpoint, where the upper right box displays the heading to the next Steerpoint.
  - 11) **Standby Attitude Indicator** – Backup Attitude indicator.
  - 12) **Fuel Flow Indicator**—listed in pounds per hour.
  - 13) **NOZ POS Indicator**—Position of turbofan's nozzle opening.
  - 14) **RPM Indicator**—Turbofan's revolutions per minute.
  - 15) **FTIT Indicator**—Fan Turbine Intake Temperature measured in degrees Celsius.
  - 16) **Magnetic Compass**—shows heading of aircraft with respect to magnetic north.
  - 17) **Fuel Quantity Indicator**—displays total pounds of fuel remaining.
  - 18) **Caution Light Panel**—Yellow or Red lights will indicate which systems are failing.
  - 19) **TWI**—The Threat Warning Indicator is detailed later in this chapter.
  - 20) **MFD**—The Multifunction Display is detailed later in this chapter.
  - 21) **HUD**—The Head-Up Display is detailed later in this chapter.

## Warnings

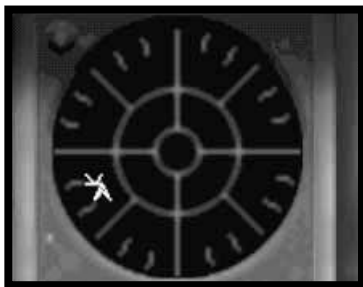
Your onboard computer will attempt to warn you of hazardous conditions. Receiving the **WARNING** or **CAUTION** as an audible cue and on the HUD, indicates that you should check your instrument panel for possible system failures. The word **TERRAIN**



will appear if a ground collision is imminent and an arrow will point in the direction of the threat. Immediately pull your craft away in the opposite direction. Unless you are in the process of landing, you will hear an **ALTITUDE** warning when your F-16 dips below 400 ft. Keep an ear out for the ominous **BINGO** warning, which alerts you to the fact that you are nearly out of fuel.

## Threat Warning Indicator

The Threat Warning Azimuth Indicator shows you the direction and type but not proximity of radar threats. This is a God's eye view looking down on your aircraft, where the top of the indicator represents what is in front of you. The outer circle will display ground radar sites and aircraft, while the inner circle will only show incoming radar guided missiles. Here are the symbols you will see:



◇ **AWACS**

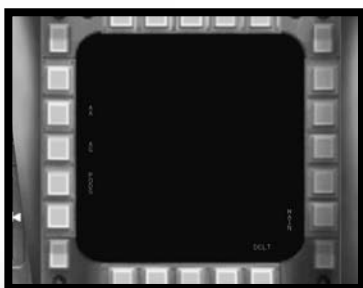
△ **Aircraft**

▽ **Ground Radar**

▽ **Incoming Radar Missile**

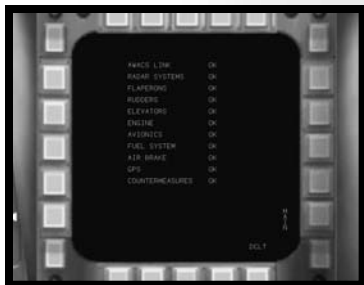
## Multifunction Displays

The F-16 features a number of displays designed to present data in graphical form for quick analysis. You can change the MFD modes with **Insert** and **Page Up** or by pressing the appropriate MFD button with the mouse. The **DCLT** button will declutter the screen by removing the mode button labels. The other buttons are labeled as follows:



## WEP

You can select your air-to-air missiles (**AA**), air-to-ground ordnance (**AG**), or prepare to eject your fuel pods (**PODS**) with this screen.

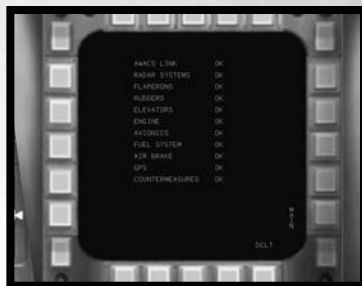


## STAT

If your F-16 suffers system failures due to aircraft damage, you will be notified in this MFD mode. Use this regularly to check on the status of your vital systems.

## STORE

The Stores Display indicates the type and number of armament or fuel pods currently on the nine stations. It also indicates remaining Flares, Chaff bundles and 20mm rounds.

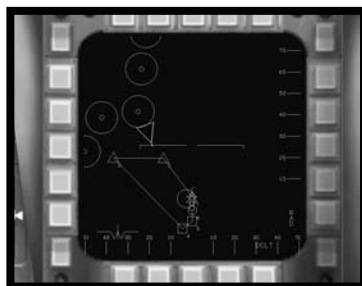


## RAD

The pilot has many options to consider when using the Radar MFD. There are six separate modes to choose from, two Air to Air modes and four Ground or "Look Down" Radar modes. Enemy targets will appear as triangles, Friendlies will appear as circles and unidentified targets show up as squares. A small line attached to the symbol will indicate which direction they are heading. Your selected target will be encased in a circle. The centerline indicates the roll of your aircraft. The ticks at the end of these lines will point toward the horizon to indicate whether you are diving or climbing. Information regarding your Steerpoint can be found in the bottom corner. The radar's cone size can be adjusted with the **[S]** (zoom in) and **[X]** (zoom out) keys.

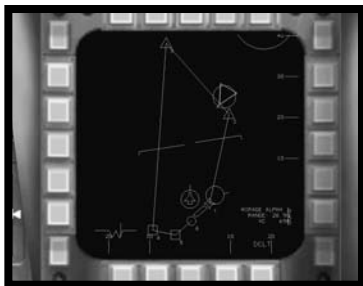
## SAM - Air Situational Awareness Mode

With a radar range of about 80 nautical miles, this mode displays a wealth of information. Your Steerpoints and predetermined bombing targets, along with information on AWACS and air targets can help you get a better understanding of your entire situation.



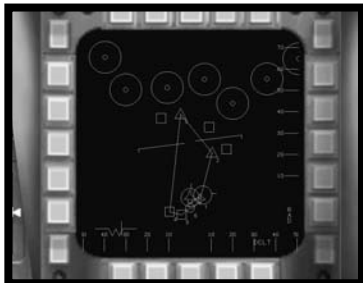
## ***ACM - Air Combat Maneuver Mode***

Focusing on air combat, this mode shows only air targets within your combat radar range (40 nautical miles).



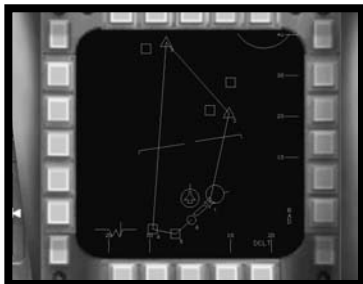
## ***SAM - Ground Situational Awareness Mode***

Similar to the Air Situational Awareness Mode, this display shows all relevant information, except air targets.



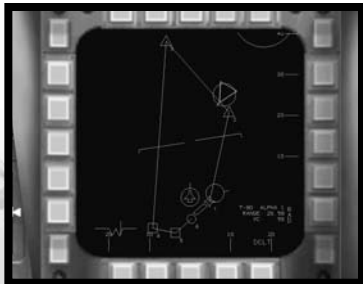
## ***FTT - Fixed Target Track Mode***

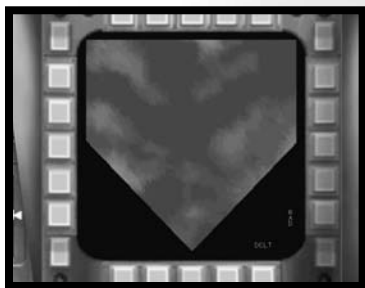
This mode further simplifies things by only showing preprogrammed static bombing targets such as buildings.



## ***GMT - Ground Moving Target Mode***

This mode will only display preprogrammed moving ground targets such as tanks and trucks.



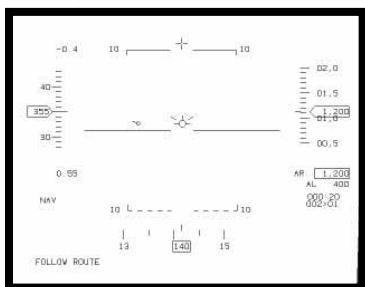
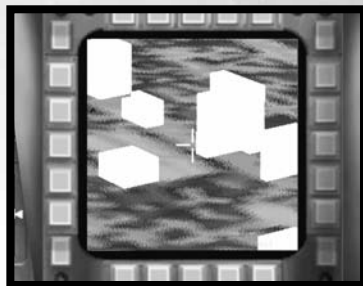


## **MAP - Ground Mapping Mode**

This MFD mode shows a look-down view on the terrain below you.

## **LANT Mode**

The LANTIRN pod is used to assist Electro-Optical targeting (TGT) of television guided missiles such as the AGM-65G Maverick.



## **Head-Up Display (HUD)**

By far the most important cockpit display in the F-16 is the Head-Up Display, or HUD. The HUD displays information from many sources, including the avionics systems,

radars, and weapons systems aboard your aircraft, all in a convenient and compact format. The HUD projects its data onto a transparent plexiglass screen directly in front of the pilot's field of vision. With a little practice you will be able to read the HUD quickly and easily.

There are many different modes for the Head-Up Display. Each assists you in specific tasks such as weapon firing or landing the F-16. They are as follows:

### **NAV**

This is your default mode. It contains all the basic information you need to fly the aircraft.

1. **Gun Boresight** – These fixed cross hairs indicate where bullets from your 20 mm Cannon should arrive once they achieve their maximum range.
2. **Pitch Scale** - The horizontal lines bisecting the center of the HUD are part of the Pitch Scale (sometimes referred to as the Pitch Ladder). The lines themselves are always parallel to the

horizon, and the tick marks on the tips of the Pitch Scale rungs always point to the horizon, so you can quickly determine your relationship to the horizon, no matter how extreme your maneuvers have been, or how bad the visibility is. The numbers at the end of the pitch scale lines show the pitch angle of the nose of your aircraft. Positive numbers represent angles above the horizon, while negative numbers indicate that your nose is pointing below the horizon.

3. **Gravity Force Indicator** – This number represents the amount of g affecting the plane and pilot.
4. **Calibrated Airspeed Indicator** - On the left side of the HUD is the box containing the current airspeed for your F-16, in knots (nautical miles per hour).
5. **Mach Indicator** - Just below the Airspeed Indicator box the HUD shows the current Mach number, a multiple of the speed of sound. A reading of 1.09, for example, means that the aircraft is travelling at 1.09 times the speed of sound. Mach is derived from the air speed of the F-16 relative to the air pressure (generally determined by the altitude.)
6. **Current HUD Mode Indicator** – There are several different modes in which a HUD can be in. If this line says “NAV”, then you are currently viewing the Navigation Mode.
7. **Compass Heading Indicator** - At the bottom center of the HUD screen is a box with the current compass heading of the aircraft.
8. **Selected Weapon Indicator** - At the bottom left of the HUD your F-16 displays the currently selected weapon and the number of weapons or rounds available.
9. **Steerpoint Comments** - Any special preprogrammed instructions associated with the selected Steerpoint will appear here.
10. **Roll Scale** – This marking shows the aircraft's relative bank to the horizon. This is useful for determining your aircraft's position in situations where your visibility is compromised, such as flying through the clouds. F-16's that are not equipped with the LANTIRN pod have much larger Roll Scales.
11. **Flight Path Marker** - The small circle with the vanes extending from its top, bottom, and sides is the Flight Path Marker. At any given moment the Flight Path Marker points directly to where your aircraft would wind up if all flight parameters remained the same. An “X” will appear through the Flight Path Marker if it is actually beyond the limits of the HUD. This can happen during bad spins or extreme maneuvers.

12. **Barometric Altimeter** - At the right of the HUD is a box containing the aircraft's current altitude, in feet Above Sea Level (ASL).
13. **Radar Altimeter** - At the right of the HUD is a box marked "AR" containing the aircraft's current altitude, in feet Above Ground Level (AGL).
14. **Altitude Low Setting** - If your radar altitude gets below this number, you will be given a warning. The ground crew preset the "AL" at 400 ft.
15. **Time to Next Steerpoint** - Measured in minutes and seconds.
16. **Selected Steerpoint** - Gives the distance in nautical miles to the next selected Steerpoint followed by that Steerpoint's ID number. Cycle through the Steerpoints for the mission with the **[N]** key.
17. **Command Steering Cue** - The "tadpole" marker indicates the direction to steer to reach the next Steerpoint. When you are heading directly towards the Steerpoint, the Command Steering Cue will line up inside the Flight Path Marker.

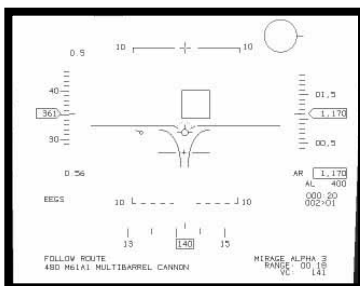
## EEGS

Although you can fire your cannon at any time with the **[Z]** button, the Enhanced Envelope Gun Sight will greatly aid you while the M61A1 is selected (press **[2]**).

1) **Bullet Flight Path** - The EEGS mode automatically compensates for relative velocity and position of your target. Line up your target so that its wingtips touch the funnel lines for optimal accuracy.

2) **Range Scale** - This indicates the range of the designated target. The dial moves counterclockwise as you get closer to your target.

3) **Maximum Gunnery Range** - The dot at 3 o'clock represents 3,000 ft, which is the maximum effective range of your M61A1 20mm Cannon.



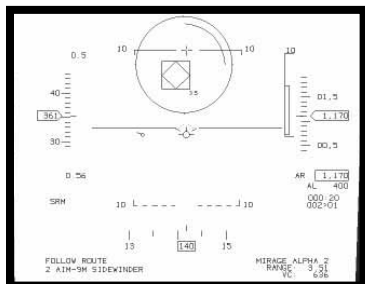
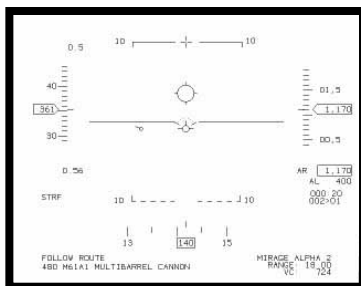
## Strafing Mode

When you wish to attack ground targets with your M61A1 cannon, use the Ground Strafing Mode.

- 1) **Gun Aiming Piper** – maneuver the aircraft to position this dot over your target.

## SRM

The Short Ranged Missile mode is displayed when AIM-9M Sidewinders are selected.



- 1) **Boresight Circle** – In order to establish a radar lock, the Boresight Circle must contain the Target Box. Note that the heat seeking tracking head can slew, attempting to gain a lock independently of your heading.

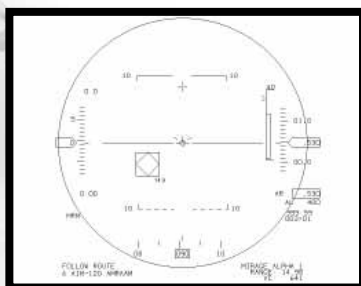
- 2) **Missile Range Scale** – This scale shows the effective range of the missile. The arrow indicates the current range to the target. The top portion of the scale represents your radar's combat range. The middle portion is called the "Kill Zone"; this is the effective range of the missile. The bottom portion represents the range at which it is too close to effectively fire the missile.

- 3) **Target Range** – This circular scale indicates the distance to your target. As you get closer, the scale will shift counterclockwise.
- 4) **Target Box** – When you have your radar turned on, all aircraft within your radar range will appear on your HUD as a dashed box. When you select a target, it will become a solid line box.
- 5) **Missile Lock Diamond** – When the target is within range and the missile has achieved a positive lock, a diamond box appears in the Target Box.

## MRM

When the AIM-120 AMRAAM is armed, the Medium Ranged Missile mode will appear on the HUD.

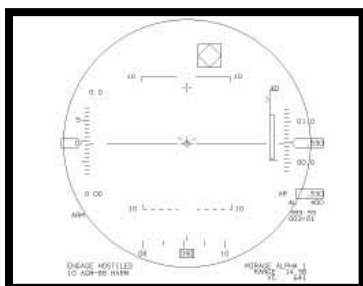
- 1) **ASE Circle** – The Azimuth Steering Error Circle represents the radar view of the selected missile (not your aircraft's radar). The ability of the seeker head to slew around enables it to sometimes lock on targets that you can not see.



- 2) **Boresight Circle** – In order to establish a radar lock, this circle must be within the ASE and your target must be within range. Note, because the seeker head's radar can slew, you do not have to have the Target Box within the ASE, only the Boresight Circle.
- 3) **Missile Range Scale** – This scale shows the effective range of the missile. The arrow indicates the current range to the target. The top portion of the scale represents your radar's combat range. The middle portion is called the "Kill Zone"; this is the effective range of the missile. The bottom portion represents the range at which it is too close to effectively fire the missile.
- 4) **Target Range** – This circular scale indicates the distance to your target. As you get closer, the scale will shift counterclockwise.
- 5) **Target Box** – When you have your radar turned on, all aircraft within your radar range will appear on your HUD as a dashed box. When you select a target, it will become a solid line box.
- 6) **Missile Lock Diamond** – When the target is within range and the missile has achieved a positive lock, a diamond box appears in the Target Box.

## ASM

When the AGM-84A Harpoon is armed, the Anti Ship Missile mode will appear on the HUD. Unlike the MRM mode, the ASM is used to target ships that have been preprogrammed as legitimate targets, otherwise refer to the MRM mode for details.



## ARM

The Anti Radiation Missile mode appears when the HARM is selected.

- 1) **Target Box** – This box indicates a potential ground target for you to lock onto.
- 2) **Missile Lock Diamond** – When the target is within range and the

missile has achieved a positive lock, a diamond box appears in the Target Box.

## EO

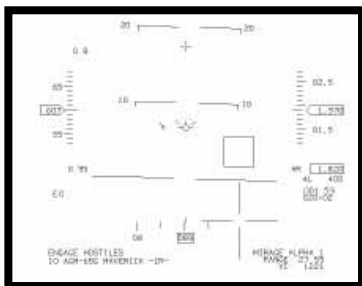
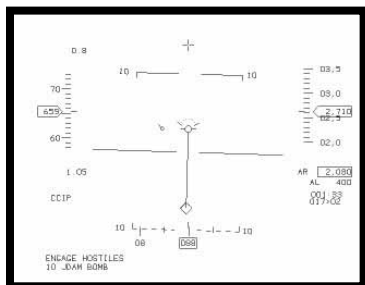
The Electro-Optical mode shows you a television view from such missiles as the AGM-65B when they are selected.

- 1) **Target Box** – This box indicates a potential ground target for you to lock onto.



## 2) Weapon Seeker Cross Hair –

When the ground target is in range and acquired, the cross hairs will line up over the Target Box to indicate that the weapon may be fired at will.

**CCIP**

The Continuously Computed Impact Point mode appears when you have bombs armed.

1) **CCIP** – The Continuously Computed Impact Point or “Death Dot” shows where the bomb will

detonate. Aim this small circle onto your ground target.

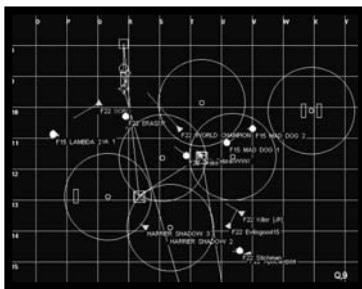
2) **Bomb Fall Line** – This line will indicate the path the bomb will take from your F-16 to its target.

**ILS**

The Instrument Landing System mode assists you in landing the F-16. When you are facing a runway from the proper side, the ILS will appear to give you guidelines to help line up the runway with your plane. See **Chapter 6, Landing** for HUD details.

## ***Tactical Map***

Press **M** to bring up the Tactical Map. This God's Eye view is extremely useful for coordinating attacks in Multiplayer games. Refer to the grids to effectively communicate your location to teammates.



# LANTIRN

The **Low Altitude Navigation and Targeting InfrARed for Night** system allows F-16 pilots to operate in total darkness as well as all weather. The LANTIRN consists of a navigation pod and a targeting pod integrated and mounted beneath the F-16. Enhanced with terrain-following radar and a fixed infrared sensor, the aircraft is capable of precision strikes in all conditions.

To activate the LANTIRN pod, press the **F9** key. The pod's sensor will illuminate your HUD green with an infrared image of the forward terrain.

## Chapter 6

# Flying F-16

## Tutorials

You can fly any available F-16 mission whenever you wish, but we recommend that you begin your experience with this simulation by undertaking the **Tutorial Missions**. It won't take long, and even if you are an experienced flight sim pilot, you will come out of the experience better able to control the F-16.

The F-16 Tutorial Missions are part of the Quick Mission set, available from the Main Menu.

**Mission #1**—Introduction to the basic workings of the aircraft.

**Mission #2**—Practice Landing

**Mission #3**—Introduction to Air Combat Maneuvers

**Mission #4**—Basics of Air to Ground Guided munitions

**Mission #5**—Practice at Air to Ground Unguided bombing

**Mission #6**—This mission has no enemies or other distractions, and is designed to give you a place to practice flying the F-16.

## Prepare for Takeoff

Take a moment to review the mission in your mind, concentrating on the tasks you must perform, then get ready for takeoff:

- Check your HUD. Note the altitude of the runway and the direction you are pointing. When you return to base you will want to know this information. In the lower left of the HUD you should see the letters **G**, **F**, **B**, and **R**. They indicate that your brakes are applied, your landing gear is down, your flaps are extended, and your radar is on. In the upper right corner of the screen is a miniature version of the Situational Awareness Mode MFD. Toggle it on and off with the **F11** key.
- Turn on the engines. Press the keyboard **7** key to turn your engines on and set them to idle.

## **Takeoff**

Once you are cleared for takeoff, you will need to quickly bring the aircraft up to speed before you can achieve liftoff. Takeoff velocity in the F-16 is approximately 160 knots, depending mainly on the loadout weight of your aircraft.

- Set your engines to Full Military Power (100%). Press the **[0]** (zero) key to bring up maximum normal thrust. Your F-16 will start to accelerate down the runway, rapidly picking up speed. Keep your eye on the Airspeed Indicator at the left of the HUD. It should reach 160 knots about one-third of the way down the runway unless you have an exceptionally low or high loadout weight.
- If you need to get in the air quicker, use your afterburners by pressing **[backspace]**.
- When the Airspeed Indicator reaches 160 knots, you are ready to “rotate,” or liftoff from the runway. Pull back gently on the stick, and keep a little back pressure on. Pitch the nose of your aircraft up about 20 degrees (use the HUD Pitch Scale to determine your pitch.) Gain some altitude as soon as possible, just in case the engine should fail or some other in-flight emergency occurs. You do not want to be too close to the ground if that happens.

## **Climb Out to Mission Altitude**

Now that you are in the air and headed for mission altitude, it's time to clean up the airplane and prepare for the mission.

- As soon as you are airborne, it's safe to raise your landing gear. If you selected Manual Landing Gear in the Options, press the **[6]** key. The small “G” at the lower left of your HUD should disappear, indicating that the gear is up. Your landing gear can not handle the pressures of high speed and become in danger of tearing off at airspeeds greater than 250 knots.
- At this point, you should reduce thrust to save on fuel. Press the keyboard **[9]** key to put your engines on Cruise setting. You will hear a distinct difference in the sound of the engines.
- Maintain a steady climb, keeping your pitch angle at about 20 degrees. Your Barometric Altimeter, in the box on the right side of the HUD, gives you the altitude of your aircraft, in feet Above Sea Level (ASL). Your distance above the actual ground (Above Ground Level—AGL) is measured by the Radar Altimeter located in the box below the Barometric Altimeter.

- When you reach an altitude of about 25,000 feet, level off. You can do this manually by using the joystick, or you can just press the **[L]** key. This automatically puts the F-16 in straight and level flight. You are ready to continue with your mission.

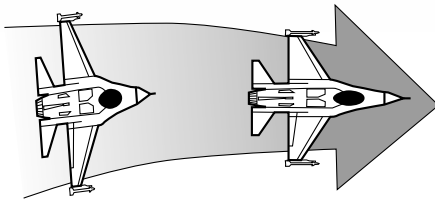
## Basic Flight Maneuvers

Your piloting skills will improve with understanding and practice only. You should take ample time to master each of the Basic Flight Maneuvers (BFM) listed below. This fundamental understanding is key to your survival.

***Always know where you want to put the plane. You should make deliberate and controlled movements to get it there.***

### Turns

The first of the Basic Flight Maneuvers to master is the simple turn. Smooth, well controlled turns are the hallmark of the expert pilot. Practice turning until you can do so with precision, and without wasting time, altitude, or airspeed.

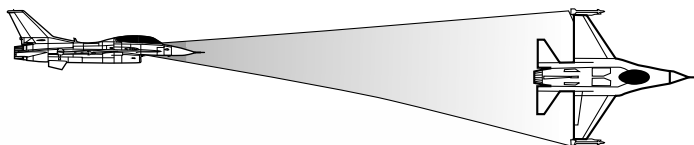


- Start this series of turns from level flight. You will not, of course, always be in level flight when you initiate a turn, but for this practice session start from straight and level. Use the **[L]** key to level your aircraft if you have trouble keeping it stable.
- Note the direction you are flying. Check the compass indicator in the box at the bottom of your HUD to determine your compass heading.
- Note your speed and altitude. The boxes at the side of the HUD will tell you your airspeed and altitude above sea level.
- Now make a 120 degree turn to the left. Push the handle of your joystick part way to the left, and at the same time pull back on it slightly. Hold your aircraft in this flight attitude until your compass heading is 120 degrees left of your original direction, then use the joystick to bring the aircraft back to straight and level on the new course. Use the **[L]** key if you have to.

- Check to see if you have lost any speed or altitude in the turn. Anytime you maneuver in the air you potentially lose energy, so always keep an eye on your speed and altitude. Lose too much of either of these and you'll wind up dead.
- Practice turning. The farther you push the stick to the right or left during a turn, and the farther back you pull on it, the faster the turn will be. Practice both sharp and gentle turns. Strive to make your turns crisp and precise, so that you come out of the turn facing the direction you want to be going. Make each turn a definite movement, with a clear objective.
- When you have spent some time practicing turns, and you are ready to go on, check your fuel supply to be certain you have enough jet fuel to continue. Make sure you have plenty of altitude. You'll need it for this next session.

### ***The Break Turn***

The Break Turn is an emergency combat maneuver. It is very expensive in terms of energy (you risk losing lots of speed and altitude). A break turn can let you cut inside the turning radius of an oncoming missile, or throw off an opponent who is moving in for a gun kill. Break turns are most effective when performed suddenly and unexpectedly.

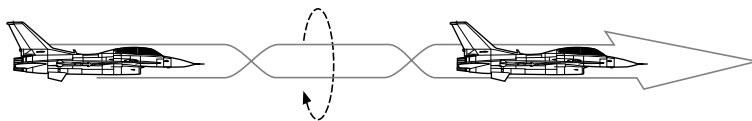


- To start practice, get straight and level, then note your speed, heading, and altitude.
- Break right! Quickly push the stick all the way to the right, and pull it back all the way. This is actually two movements, but they should be performed very quickly and precisely. The first movement, to the right, rolls your aircraft until its wings are perpendicular to the ground, or even a little farther. Pulling back on the stick sharply then causes a very rapid turn. Watch the Pitch Scale on your HUD to determine when you have rolled the aircraft sufficiently far to the right to make the turn crisp.
- Try to maintain the turn through at least 90 degrees of heading. Note how much speed and altitude you are losing in this turn. Never hold a break turn for so long that you are unable to maneuver (have little speed or altitude) when you come out of it.

- Break turns place extreme G-forces on the plane and pilot, and can lead to Blackouts from sustained high G force. The F-16's flight control computers limit the amount of G the aircraft will pull (-3.0 G to + 9.0 G), but if you hold a break turn too long and the screen begins to go dark, relax the joystick to reduce the tightness of the turn, or use the **[B]** key to activate your Air Brakes to reduce the aircraft's speed through the turn. Don't forget to deactivate the air brakes when you no longer need them. You can choose whether you wish to have F-16 simulate blackouts from high-G turns and Redouts from negative-G situations. Go to **Options** on the **Main Menu**, and check **Blackouts/Redouts**.
- Practice break turns. As with any aircraft control movement, strive to make your breaks crisp and precise, with a definite purpose in mind. When you are good at break turns, you will be able to come out of one heading in precisely the direction you want to go. Watch your speed and altitude whenever you are performing break turns.

## Roll

A Full Roll consists of a complete rotation of the aircraft around its longitudinal axis, from level flight to inverted, and back to level. As with all aerial maneuvers, make your rolls precise and efficient. Ideally, a roll should not include any forward or backward pressure on the joystick, and you should come out of the roll headed in exactly the same direction you were headed when you started it.

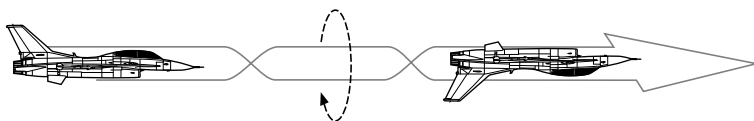


- Make sure you have plenty of altitude and airspeed, then get into level flight and check your airspeed, heading, and altitude for reference.
- Roll left. Push the stick to the left, without any forward or backward pressure. Hold the stick to the left as you roll through inverted flight and back to your original orientation, then level off. You should be headed in the same direction you were when you started the roll, and you should not have lost very much speed or altitude. If you did lose a lot of speed or height, that probably means you were performing the roll too slowly.

- Practice rolls. Always try to make your motions smooth and definite, with a precise objective in mind. Practice rolling until you can perform the maneuver without causing too much change in the direction your aircraft is headed.

### **Half-Roll**

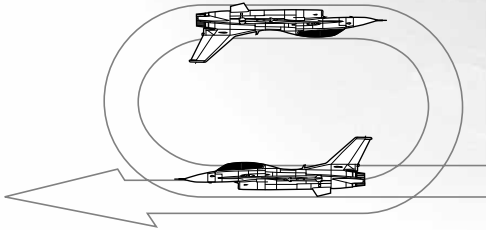
The full roll is not really a very useful maneuver. After all, you wind up right back where you started. The Half-Roll, on the other hand, is quite handy. It is an important component of several of the more complex flight maneuvers, like the Immelmann and the Split-S.



- Get yourself plenty of altitude and airspeed, then check your compass heading for reference.
- Half-roll your airplane. Push the stick right or left, and hold it in that position until you are flying inverted. Use the HUD Pitch Scale to determine when you have achieved inverted flight. Stop the roll when your wings are level and you are flying upside down. Properly done, a half-roll should be quick and precise, without overshooting the roll and having to correct. There should be little change in the compass heading of the aircraft.
- Half-roll again to regain normal flight.
- Practice half-rolls. Try to make them definite and rapid, with no wasted motion. Note the loss of airspeed and altitude associated with this maneuver, so you will know when it is safe to perform.
- Check your fuel supply before continuing.

## Loop

The Roll was a motion without any forward or backward pressure on the stick. The Loop is a maneuver that requires no right or left pressure. Properly done, a loop will deliver your aircraft back to where it began, with nearly the same heading, altitude, and airspeed that you had when you initiated the loop.

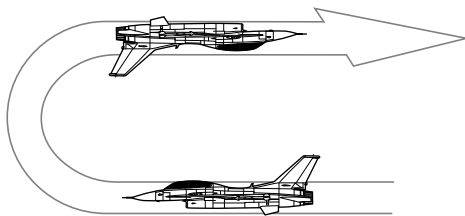


- Check airspeed, altitude, and heading for reference. You won't be able to tell if you have performed the loop properly unless you know where you started the maneuver.
- Get up a little airspeed by going into a shallow dive.
- Loop your aircraft. Pull back on the stick and hold it back while the airplane goes through a complete circle, then push the airplane back to level when you approach normal flight attitude again. Stay aware of where your airplane is during the loop, and keep a close eye on your altitude and airspeed indicators. Try to keep the Pitch Scale rungs horizontal through the loop. When you are coming out of the loop, make your control motions definite and precise. You should be headed the same direction you were when you began the loop, and your altitude and airspeed should be pretty much the same as when you started.
- Practice looping. Try to visualize the movement of your aircraft through the air so you always know where you are in the loop, and can come out of the movement easily and under control. Perform loops at various speeds, and note how much altitude or speed you lose. You should always know the energy price of any maneuver you undertake.
- When you are satisfied with your loops, regain any altitude you may have lost then check your fuel supply before going on.



## **Half-Loop**

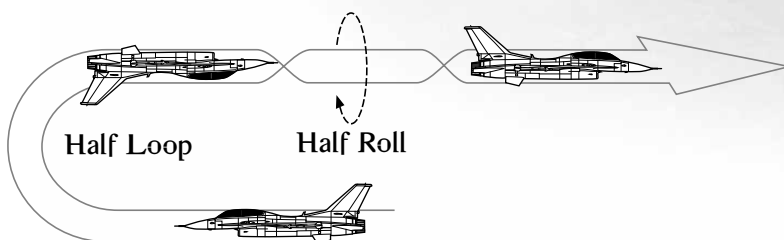
Like the Roll, the Loop is more useful as a part of a more complex maneuver than it is by itself. A loop merely returns the aircraft to its start conditions. A Half-Loop, on the other hand, is a maneuver you will have to get good at, since it is a vital part of some of the most effective air combat maneuvers. When performing a half-loop, keep your awareness high, and make all your control motions quick and precise. You should have a little snap in each movement.



- As usual, check your altitude, airspeed, and heading before starting.
- Perform a half-loop. Pull back on the stick until you are flying inverted, on an opposite course from that with which you began the maneuver. Use the HUD Pitch Scale rungs to keep aware of where you are in the turn, and to help keep your wings level through the movement. Hold yourself in inverted flight for a few moments. Note how much speed or altitude you have lost by half-looping.
- Practice half-loops. Enter the maneuver at various speeds, and make your half-loops of different sizes by pulling back softer or harder on the stick when you are initiating the motion. Stay under control at all times, and stay aware of where you are in the maneuver. Practice breaking out of the half-loop quickly and cleanly, ready for the next movement.
- When you can reliably perform a half-loop, check your fuel supply, and then regain mission altitude to continue.

## The Immelmann

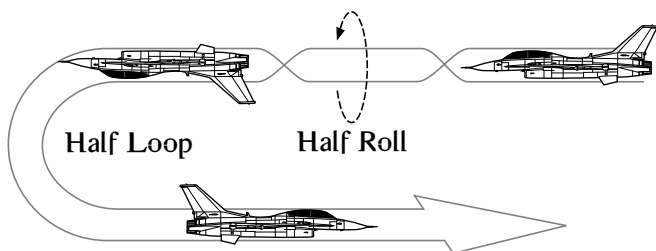
An Immelmann turn is a combination of a Half-Loop and a Half-Roll. It is an excellent way to simultaneously gain altitude and lose speed, which can be just what you want when you are getting ready to enter an air combat engagement. An Immelmann is also a good way to reverse direction to throw off an enemy or to recover after an attack. When you are good at Immelmans you can come out of the maneuver headed any direction you like. As always, make your control movements quick and precise when performing this maneuver, and watch your heading, airspeed, and altitude.



- Check initial heading, airspeed, and altitude.
- Perform a half-loop, then a half-roll, so you wind up flying right side up, in the opposite direction from your previous course and at a higher altitude. Start the half-loop by picking up a little speed, then half-loop into inverted flight. When inverted, and flying on the opposite course, half-roll the aircraft back upright.
- Practice Immelmann turns. Concentrate on making your control movements with authority, putting the aircraft exactly where you want it to go. Also practice coming out of the turn. When you are half-rolling out of an Immelmann you can break the half-roll at any point, or hold it longer than normal, so that you come out of the Immelmann on any course you desire. The main idea of the Immelmann turn is that you will make a significant course change, and wind up at a higher altitude.
- When you are good at Immelmans, check your fuel supply, and then regain mission altitude to continue.

## ***The Split-S***

A Split-S is the opposite of an Immelmann. First you half-roll to the inverted position, then you pull back on the stick and do a half-loop. You wind up with a lower altitude and greater speed, headed in the opposite direction to your original line of flight. A Split-S is a good way to increase your energy state.



- Check your altitude, airspeed, and heading.
- Do a Split-S. Half-roll to the inverted position, then pull back on the stick and do a half-loop until you are right side up and flying level again. Keep an eye on the HUD Pitch Scale rungs to stay informed about your attitude, and stay aware of how much altitude you are losing. You should wind up on a course close to the opposite of the one with which you started.
- Practice the split-s. If you find that you are losing a lot of altitude with this maneuver, try slowing down before you initiate the movement, or deploy your air brakes (use the **B** key) to reduce your speed through the half-loop. Don't forget to retract the air brakes when you have finished the turn. With practice, you should be able to come out of a Split-S on any desired course, so pay attention to your heading as you come out of the maneuver, and leave the half-loop whenever you need to in order to assume the course you want.
- Keep an eye on your fuel supply. If you still have plenty after getting good at the Split-S, continue with flight practice. Otherwise, turn to the section on landing the F-16 (below) to return to base for more fuel.

## Landing the Aircraft

When you land your F-16 during missions, the ground crew will re-arm and refuel you. They will not have time, however, to fix any damages you may have incurred. In this simulation, simply bringing your F-16 to a successful stop on the landing strip will refresh your fuel and ordnance. Although most missions do not require that you land the aircraft, you will receive a significant mission score bonus if you do. It is generally a good idea to bring the aircraft home after finishing your mission.

When you are ready to land, press the **[H]** key. This will activate the Autopilot and guide your aircraft directly to the Initial Approach Steerpoint. At this point the navigation system updates the autopilot with the next Steerpoint, the Final Approach Steerpoint. From the Final Approach Steerpoint you proceed directly to the runway. Going through the Initial and Final Approach Steerpoints keeps you clear of any other traffic that may be flying near the runway, and gives you a chance to get your F-16 set for landing.

Be careful about using the autopilot while there are still enemies active in the area. The autopilot is only capable of directing the aircraft to preprogrammed Steerpoints; it is not designed to avoid SAMs and enemy fighters while on route. Take manual control of the plane if there are still enemies around. Cycle through your Steerpoints with the **[N]** key until the Initial Approach Steerpoint appears, then use the Command Steering Cue in the center of the HUD to help you steer to the direction you need to go.

To help keep aircraft from running into one another, the air traffic controllers at an airbase maintain an air traffic pattern in the sky, including corridors through which each aircraft is to fly. All aircraft taking off or landing must travel in the same direction, so before you leave a base you should note the direction that traffic flows around it. Then when you are returning home you will know ahead of time from which direction you will want to approach the runway.

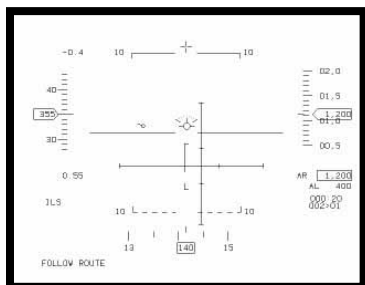
Your Instrument Landing System (ILS) display on your HUD can be of significant assistance in landing, helping you keep the proper altitude and aligning you with the runway. The ILS only functions if you approach the runway from the proper direction. If you attempt to land against the flow of traffic, the ILS will not show up on your HUD.

Landing can be the most dangerous part of controlling an aircraft. You are flying low and slow, with little margin to correct an error should something go wrong. Pay attention to the landing process, and keep focused on what you are doing.

## **Instrument Landing System**

The F-16 has an Instrument Landing System (ILS), which provides a means of landing the aircraft even when you can't see the runway. The ILS has several components, including a Glideslope Bar, showing

you where your glide actually is, and a Localizer to get you oriented properly with the runway. The ILS activates when you are less than six nautical miles from the runway, and at an altitude of less than 5,000 feet AGL (Above Ground Level) with gear down.



approaching the runway at the proper altitude this line will be centered.

- 2) **Localizer**—The solid red vertical arrow is the Localizer. Its job is to keep you oriented along the runway centerline. If you are pointed to the left of the runway centerline the Localizer will point to the right side of the HUD, while if you are too far right, the Localizer line points left. When you are pointed correctly the Localizer arrow points directly down.
- 3) **Angle of Attack Indicator**—Displays your current Angle of Attack.

When in ILS mode the HUD also changes some of the other parts of its normal display. It now shows the Gear Lowering Speed next to the Airspeed Indicator box at the left of the HUD, and the Desired Heading just above the Altitude box on the right. Press **[G]** to lower your landing gear and extend flaps when your airspeed falls below the Gear Lowering Speed, and keep pointed to the Desired Heading.


## ***At the Initial Approach Steerpoint***

Your Initial Approach Steerpoint is usually about 15 miles from the runway. Its purpose is to get you to the vicinity of the runway, yet still leave you time to get set for landing. Approach the Steerpoint at an altitude of about 5000 feet AGL, with a speed of around 400 knots. Well before you reach the Steerpoint you should reduce the throttle to 60% to slow yourself down gradually. It is better to allow your airspeed and energy to bleed off slowly rather than have to use your airbrake to reduce speed.

## ***At the Final Approach Steerpoint***

The Final Approach Steerpoint is normally about five or six miles from the runway. By the time you reach this Steerpoint you should be at an altitude of around 1500 feet AGL, with an airspeed no greater than 250 knots. Your main task now is aligning yourself properly with the runway.

Locate the centerline of the runway and use your stick to bring the nose of the aircraft into alignment with it. Avoid sharp banks and sudden turns. Gradually reduce both your altitude and airspeed.

When you are aligned with the runway centerline, check your airspeed to make sure that you are at about 160 knots. This gives you a little airspeed to play with if anything goes wrong. Press the  key to lower the landing gear. You will notice a distinct drop in airspeed as the landing gear deploys and locks into place.

Now you are on Final Approach. Perform the following checklist to make certain that your aircraft is properly configured for landing, and that the runway is clear for your use:

- Check to see that the traffic pattern is clear.
- Check to see that your wings are level. Use the Artificial Horizon Indicator if necessary.
- Check to see that your landing gear is extended. The flaps on the wings of your F-16 will extend with the landing gear, providing you with extra lift. If you try to land without lowering your landing gear, you will receive an audio warning.
- Check your airspeed. It should be between 150 and 175 knots. Do not extend your airbrakes if your speed is within this range.
- Check the HUD Pitch Scale. Your pitch angle should be about 10 degrees.
- Check your HUD to confirm that the ILS is engaged. It will be visible on the HUD when you are approaching the runway from the proper direction and your gear is down.

## ***Touchdown***

Keep your aircraft aligned with the runway centerline. Your landing gear should straddle the centerline on touchdown. Continue to lose altitude as you near the runway, but keep your pitch angle up. You do not want to dive into the runway. Time your touchdown so that it occurs in the first 1/3 of the runway. This will give you plenty of braking distance, or room to take off again if necessary.

Just before touchdown, pitch the nose of your airplane up slightly. This maneuver is known as a "flare." Use a flare to make sure that your rear wheels are always the first to make contact with the ground. If your nosewheel hits the ground first it can cause the F-16 to nose into the ground and crash.

When your wheels touch down you will hear the squeal of the tires. Apply brakes with the **[B]** key to bring the aircraft to a gradual halt. Once the aircraft has completely stopped, wait to be re-armed to takeoff again or press the **[E]** key to finish the mission and start the post-mission performance analysis. You are home, and safe. Congratulations!

## ***Stalls***

A Stall can happen any time a wing surface can no longer provide enough lift to keep an airplane flying. Low speeds and high Angles of Attack are the most common causes of stalls. The most dangerous time to experience a stall is when you are flying low and slow, like when you are landing.

The F-16's stall speed in any given situation depends on a number of factors, such as the weight of the aircraft, its speed, the angle of attack of the wings, and whether or not it has its flaps and gear extended. In general, you should consider 120 knots too slow a speed for safe flight at low altitudes. To avoid stalls when landing, keep your airspeed above 140 knots and your angle of attack low.

If you do manage to stall the F-16, immediately drop your nose to reduce the angle of attack, raise the landing gear, and hit the afterburner (the **[backspace]** key) to maximize engine thrust. Keep your wings level. As your airspeed increases, you will get more lift from the wings, which will allow you to fly out of the stall.

## **Chapter 7**

# **Air Combat**

As the world's premier multirole fighter plane, the F-16 has the capability of taking on a number of different types of missions. Proven reliable by experience, it is used for air defense, sea defense, battlefield support, reconnaissance and precision bombings. But despite its highly configurable payload, the F-16 is no better than the pilot flying it. Relying on advanced radar warning and quick reflexes, the F-16 pilot must be up to the challenge of combat.

## **Radars**

The primary means by which modern aircraft detect and track one another is by radar. Mounted in the nose of the F-16 is the APG-68 Westinghouse multimode radar. The APG-68 can detect any potential target to the front or sides of the aircraft, to a range of 80 nautical miles in Situational Awareness Mode, or up to 40 nautical miles in combat mode. With the APG-68, the F-16 can create a "shootlist" of the multiple targets, allowing the pilot to target and engage all of them simultaneously. If you turn off your radar, you will lose your shootlist, unless there is an AWACS on station to support you.

Many F-16 missions provide the player with an AWACS (Airborne Warning and Control System) aircraft, usually a modified Boeing E-767 with a Westinghouse AN/APY-2 radar mounted on top of the fuselage. The AWACS automatically downloads radar data to your airplane's computer system, giving you excellent radar coverage without having to turn on the F-16's internal radar set. The AWACS provides 360 degree coverage around your F-16, and can reach more than 40 miles from your aircraft. If your mission provides you with an AWACS, guard it well. It is a very useful tool, and if you let it get shot down you will be unable to take advantage of its radar coverage.

Unfortunately, the radar signal that lets you detect enemy objects in the air also announces your presence to everyone in the area. You can see some of the effects of turning on the radar by watching the radar coverage on your Situational Awareness Mode MFD. When you turn your APG-68 radar on, the diameter of the



radar coverage circles increases dramatically, reflecting the greater ease with which the enemy can now detect your aircraft. Fortunately, the radar signal from an AWACS does not give away the location of the F-16.

Radar is not the only method of detecting and tracking targets. Your AIM-9M Sidewinder heat-seeking missile, for example, relies on infrared radiation to track and kill its targets, so it doesn't need any kind of radar signal to be effective. Similarly, when you are in close combat, at gun ranges, your eyes will often be a better target tracking device than radar. You should also be aware that some of the enemy fighters you will encounter are equipped with infrared target tracking systems. These systems rely on infrared radiation to detect and track your F-16, and do not require the aircraft to broadcast a signal. You will therefore be unable to tell when an enemy fighter is tracking you with this device. Your enemies also have heat-seeking missiles, similar to the Sidewinder.

## ***Air-to-Air Weapons***

The F-16 has three different air-to-air weapons systems, each with unique characteristics, designed to engage targets under different conditions. You can fire at targets up to 25 nautical miles away with your AMRAAM radar-guided missile, engage enemies at up to 5 nautical miles with the Sidewinder heat-seeking missile, or close to under 2 miles and blast away with the M61A1 six-barreled 20mm cannon.

### ***AIM-120 AMRAAM***

***Type: Air to Air Missile***

***HUD Mode: MRM***

***Guidance: Radar***

***Range: 25 nautical miles***

***Weight: 332 pounds***



The AIM-120 AMRAAM (Advanced Medium Range Air to Air Missile) is a high-supersonic, day/night/all weather Beyond Visual Range (BVR), fire-and-forget air-to-air missile. Although it relies on the F-16's internal APG-68 radar to acquire targets, it can track them all on its own. Shortly after launch, an independent radar system in the missile's nose takes over the tracking task and guides the missile to its target, leaving the pilot free to concentrate on other tasks, and other targets. Housed in a light-weight structure of steel and titanium, the AMRAAM contains a 40-pound high-explosive warhead. The missile has an effective range of over 25 nautical miles and can achieve a speed of Mach 4.

## ***AIM-9M Sidewinder***

***Type: Air to Air Missile***

***HUD Mode: SRM***

***Guidance: Heat***

***Range: 5 nautical miles***

***Weight: 188 pounds***



The Aerial Intercept Missile Nine, AIM-9M, is nicknamed the Sidewinder due to the peculiar back-and-forth motion it makes when tracking a target. The infrared guidance head enables the missile to hone on the target aircraft's engine exhaust. Pilots frequently comment that the missile will "growl" while it is seeking to find a target, then emit a steady tone once one is acquired. The AIM-9M is an "all-aspect" missile, meaning that it can track a target from any angle. Because the missile does not rely on the F-16 radar, the pilot is free to leave the area or take evasive action while the missile guides itself to the target. Less expensive than other types of guidance systems, the infrared seeker can be used in day or night.

## ***M61A1 20mm Cannon***

***Type: 6 barreled Gatling Cannon***

***Range: under 2 nautical miles***

The Lockheed-Martin GE M61A1 20mm Cannon provides an average of 6,000 rounds per minute with six rotating barrels. The rate of fire is so fast that it sounds like a raspy hum. The M61A1 is located at the portside of the fuselage and fed by the ammo drum located just behind the cockpit. Ammunition is loaded through an access door on the bottom of the starboard wing, next to the air intake. This weapon is extremely valuable in close range dogfighting, where it is too close to properly engage missiles.

To engage in gun combat you must first select the M61A1 20mm cannon by pressing the **[2]** key. The M61A1 has a maximum range of approximately 2 nautical miles, but for effective shooting you should close to under 1 nautical mile. The ammo drum has a 511-round capacity.

## ***Air-to-Surface Weapons***

The F-16 has a variety of Air-to-Surface missiles and bombs to choose from, in fact more so than any other type of jet fighter.

### ***AGM-65B Maverick***

***Type: Air to Ground Missile***

***HUD Mode: EO***

***Guidance: Television***

***Range: 5 nautical miles***

***Weight: 597 pounds***



The AGM-65 Maverick is an electro-optically guided 130lb warhead missile. The pilot may launch the missile and search for a target beyond visual range with a television guidance system. The Mavericks are primarily used in the Close Air Support missions against hardened targets such as tanks.

### ***AGM-65G Maverick***

***Type: Air to Ground Missile***

***HUD Mode: EO***

***Guidance: Thermal Imaging***

***Range: 12 nautical miles***

***Weight: 664 pounds***



Unlike the AGM-65B, this missile employs an inertial infrared guidance system to grant it a considerable range advantage. In addition, it is capped with a powerful 300lb warhead, a digital autopilot and the TX-633 reduced smoke rocket motor.

### ***AGM-84A Harpoon***

***Type: Anti-Ship Missile***

***HUD Mode: ASM***

***Guidance: Radar***

***Range: 29 nautical miles***

***Weight: 1135 pounds***



Widely used by NATO, the AGM-84A Harpoon is an all-weather, over-the-horizon, anti-ship missile. The radar guided, sea-skimming cruise trajectory can effectively deliver the 488 lb. proximity warhead to its target. Although the turbojet engine is not capable of the supersonic speeds common in rocket propulsion, what it lacks in speed it more than makes up for in range. When directed at a sea target the range will significantly increase.

## **AGM-88 HARM**

**Type: Anti-radar Missile**

**HUD Mode: ARM**

**Guidance: Passive Radar**

**Range: 24 nautical miles**

**Weight: 793 pounds**

The AGM-88 HARM (High Speed Anti-Radiation Missile) is an improvement on the radar honing AGM-45 Shrike, especially in attacking Surface to Air Missile (SAM) Sites. To strike without warning, the propulsion system of the HARM is capable of Mach 3 with a far range of 25 nautical miles. Unlike the Shrike, the HARM will resort to a backup navigation system in the event of the target disengaging its radar. The F-16C is currently the only aircraft capable of housing the HARM.

## **Mk 20 Rockeye Cluster Bomb**

**Type: Anti-Tank Cluster Bomb**

**HUD Mode: CCIP**

**Guidance: None**

**Range: 7 nautical miles**

**Weight: 908 pounds**

Highly potent against tank formations, ground troops and small buildings, the MK 20 Rockeye is a superb unguided, free-fall bomb. When it is deployed, it drops some distance, then bursts open to dispense 247 dual-purpose armor-piercing shaped-charge bomblets, each of which produces its own small explosion. The Mk 20 is most effective when released from an altitude of a few hundred feet: this gives the bomblets time to spread over a specific area.

## **GBU LGB**

**Type: Laser Guided Bomb**

**HUD Mode: EO**

**Guidance: Semi-Active Laser**

**Range: 7 nautical miles**

**Weight: 500-2004 pounds**



Considered both inexpensive and competent, the GBU series consists of laser guidance heads attached to low drag, general-purpose Mk bombs. The one-inch thick steel case fragments when the nose to tail fuze ignites the explosive Tritonal 80/20 upon impact. At 500 lb., the GBU-12 Mk82 is primarily used against tanks and ground force targets. The GBU-16 1000 lb. Mk83 bomb can be utilized against small to medium sized buildings and storage tanks. As the F-16's largest bomb, the GBU-10 2000 lb. Mk84 destroys large targets such as factories, bridges, power plants, and hardened bunkers.

## **JDAM Bombs**

**Type: Joint Direct Attack Munition**

**HUD Mode: CCIP**

**Guidance: GPS**

**Range: 7 nautical miles**

**Weight: 500-2004 pounds**



The Joint Direct Attack Munition (JDAM) is a superior guidance system attached to the Mk 82 500-pound bomb, Mk 83 1000-pound bomb or the Mk 84 2000-pound bomb. The all-weather guidance system for the JDAM unit relies on internal sensors and gyroscopes and Global Positioning System (GPS) data, transmitted from a satellite. The JDAM flight system uses this data to move control surfaces on the bomb, allowing it to glide to its target without input from the F-16. The JDAM can achieve impressive accuracy with this system, usually planting the bomb within three meters of the computed impact point.

**Chapter 8****Strategy  
and Tactics**

To survive the perils of air combat, a good pilot must rely on various strategies and tactics. This section will go over some of the fundamental issues regarding flight altitude, speed, avoiding detection and incoming missiles as well as working with teammates. However, textbooks can't teach you everything. Ace fighter pilots learn from experience which tactics work best for them.

**Altitude**

***The F-16 is well suited for high altitude flying.***

A good deal of altitude gives you the ability to maneuver at will, comfortable in the knowledge that there is a large reserve of empty air below. Without having to worry about close terrain and sudden hills, you will have more time to process information displayed on your multifunction displays and cockpit instruments. An aircraft at high altitude can see farther and detect targets at greater ranges. A normal F-16 mission altitude should be between 20,000-30,000 feet.

Flying at a high altitude gives an aircraft a defensive advantage. It can see enemy missiles coming from far away, and can maneuver to avoid them. Missiles climbing to high altitude will take longer to arrive than those fired at targets closer to their own level, and will be moving more slowly, making them even easier to detect and avoid. Many surface-to-air missiles (SAMs) cannot reach aircraft flying at great heights (over 35,000 feet). You will be able to cruise over certain SAM sites with impunity, so long as you stay high in the air. However, that invulnerability can quickly disappear in a dogfight. A few break turns and a Split-S or two can seriously compromise this high altitude leverage.

High altitude flight provides offensive advantages as well. Altitude provides a convenient reserve of energy, which you can convert to speed at any time. Like missiles, enemy aircraft must approach "uphill," slowing their speed. This means enemy targets will spend

longer time inside the F-16's missile radius. A place where the F-16 can strike them, and they cannot hit back.

High altitude is the preferred place from which to drop a JDAM bomb. The JDAM does not require any emissions from its carrying aircraft to locate a target and therefore is less likely to compromise the F-16's position. Dropping a JDAM from high altitude also gives the weapon more range and striking power, since it relies on its gliding ability to reach the target location. The higher the bomb is at launch, the farther it will be able to glide before impact, and the faster it will be traveling when it hits.

## ***Speed***

***Your best speed is around 400 knots. Flying slow makes it harder to avoid enemies and their missiles. Flying faster uses more fuel but can grant additional range to bombs.***

One of the most important factors to consider when entering an engagement is the airspeed of your F-16. The velocity at which you are flying has tremendous effect on many of the basic maneuvers necessary during combat. The speed at which your F-16 can instantaneously achieve a 9g turn is called its "corner velocity". For most flight configurations that speed will probably be somewhere near 400 knots, or a little more.

Low speed maneuvers quickly compromise both velocity and altitude. In a normal aircraft, impending loss of control would signal a dangerous flight condition. In the F-16 you will not lose control, and so may fail to notice that, for example, your airspeed is down to around 100 knots, and that your aircraft is actually falling through the air rather than flying. This is an especially dangerous situation when you are in the middle of air combat, and might not have time to make regular speed and altitude checks. Since combat maneuvers usually cause loss of speed and altitude, you can suddenly find yourself in the undesirable position of going very slow at a low altitude. Flying too slowly can interfere with your ability to dodge missiles, because you cannot physically move the airplane fast enough to avoid the missile.

In general, the faster you fly, the better, or as some fighter pilots say, "Speed is life." There are a few disadvantages of flying too fast. For one, you go through fuel more rapidly. At higher velocities your turns will be much larger and your breaks less crisp. But the biggest danger is exceeding safe speeds. As you approach your Vmax (Velocity maximum), you will begin to experience turbulence. Your F-16 will explode if subjected to speeds over 800 knots.

One tactical situation that calls for high speeds is bomb delivery. The faster you are flying when you release your bombs the further they can travel, and the more kinetic energy they will have when they strike. If possible, always drop your JDAMs while at high speeds. You will be able to do so farther from the target's defenses, and your egress will be quicker.

To get the most out of your airplane, practice maneuvering it at various speeds, until you know what kind of response you can expect.

### ***Emission Control (EMCON)***

***Radar helps you locate enemies, but also compromises your position. Don't always leave it on, use it when needed.***

When your radar is turned on you increase the chances that an enemy will be able to spot your aircraft. When your radar is turned off you cannot acquire targets for your best missiles, and, if there is no AWACS available, you may not even be able to spot other aircraft until they get too close. Herein lies the dilemma of when to use your radar and when to leave it off.

The solution lies in common sense. Use your radar when you need to, and turn it off when you don't. You will need your radar to acquire targets for your AMRAAM, so don't be afraid to crank it up when you have enemy aircraft inside the AMRAAM range envelope. After you have fired your missiles and are certain the AMRAAMs are active, turn the radar off. If you are flying with AWACS support, this may be the only time you need to use your radar.

If you do not have the support of an AWACS aircraft, your internal radar is your only early warning and target detection system, so you will have to use it less sparingly than you would if the AWACS were present. Just don't get carried away. Use the radar deliberately to perform the tasks for which it was designed, then turn it off until you need it again. When flying a combat mission, turn on the radar every once in a while and make a 360 degree turn, keeping the nose of the aircraft pitched downward a bit while you turn. When you have scanned all around your location, turn off the radar and resume course, or take steps to deal with whatever your radar has turned up.

### ***Wingman Tactics***

***Remember to use your Wingman during missions. He's there to help you.***

You're not alone up there. Your wingman is perhaps your most



valuable asset in combat situations; he can double your firepower and watch your back. Don't let him go soft by just tagging along behind you, put him to the test. Your wingman should always have something important to do.

One of the most useful things you can instruct your wingman to do is cover your six. Your wingman will engage any object that targets you. When you are in the thick of things, it is often reassuring to know someone is looking out for potential threats you may have missed. Your Wingman will vigilantly look for enemies attempting to sneak up on you. As soon as the enemy turns on targeting radar, your wingman will attack, hopefully forcing the enemy to deal with the new threat rather than maintain the attack on you.

You can also use your wingman as a handy source of ordnance. By ordering your wingman to engage your target, you can keep target lock on an enemy and have your wingman launch the missiles, saving your own ammo for later in the mission. This can be especially useful on penetration missions, where you have to fight your way to an objective. Use your wingman to help punch you through the danger zones.

Don't forget that you can order your wingman to head back to base and perform a Combat Air Patrol over it. This is especially useful for intercept missions, where you are trying to stop an enemy force from penetrating and attacking your base. While you fly out and try to engage the enemy before they get too close, your wingman can stay home and deal with any enemy aircraft that manage to get by you. Having a wingman covering the base is extremely beneficial when you are trying to land an empty or injured aircraft.

## ***Missile Avoidance***

***The best way to avoid a missile is to stay out of your enemy's firing envelope. Your best strategy is to get behind your target as much as possible.***

The bulk of the air-to-air combat in which you will engage will be missile combat. Avoiding enemy missiles is therefore an important combat tactic. The better you are at avoiding incoming missiles, the longer you will stay in the air.

The first step in avoiding a missile is detecting it. Your Threat Warning Indicator will track incoming missiles for you, giving you the opportunity to set yourself up to avoid them. Check this display often. The Situational Awareness Mode MFD also shows the tracks of missiles fired at you.

Your threat warning system will audibly warn you with a series of beeps when your aircraft has been illuminated by someone else's radar systems. As soon as you are warned of an incoming missile, execute a break turn, release chaff and flares and try to find your attacker. Chaff tries to confuse radar locks, while Flares seek to decoy heat seeking missiles. Even if you don't know exactly where the missile is, it's a good bet that it knows where you are, so change things as rapidly as you can by maneuvering.

If you have a missile incoming from fairly long range (more than five or six miles), you can be sure that it is radar guided. Unlike the AMRAAMs you carry, most radar missiles require that the launching aircraft maintain a radar lock on the target until impact. It may therefore be possible to move your aircraft out of the radar coverage of the firing aircraft, which will break target lock and force the missile to go ballistic (unguided). Try to gain a position behind the aircraft that fired at you. This should force the enemy radar to lose contact.

If you cannot break the target lock of the enemy missile with chaff, with flares, or by maneuvering your aircraft out of the radar envelope of your attacker, you will have to try to turn inside it. To do this, use the missile's speed against it. First, maneuver to put the missile on your beam, approaching from the side. This will force the missile to keep maneuvering to track you, wasting its fuel, and making it overcome losses in speed and altitude due to the maneuvers. Get yourself as close to your corner velocity as you can, so you can make a very sharp turn when the time comes. Finally, when the missile is very close, perform a break turn into the missile. You are trying to turn inside the missile's turn radius, so it will not be able to follow you through the maneuver. Do not break away from the missile. That just gives it additional time to find you, and keeps you inside its maneuver envelope. Make the break three-dimensional (change altitude as well as direction) to force the missile into an even more extreme situation. With any luck the missile will miss, and you will still be flying.

## Chapter 9

# Multiplayer

There are many options to consider when selecting to play a Multiplayer game. You will need to decide whether you will **Host** the game or whether you will **Join** someone else's game. You can join a multiplayer game at any time, and leave whenever you wish. That means unless you are the Host, you do not have to be present at the initiation of an F-16 game to join in, and if you leave in the middle of a mission, the other players can continue to play without you.

To begin a multiplayer game session, first select **Multiplayer** from the **Main Menu**. Select **Host** to go to the Host Game screen (described later in this chapter). Choose **Back** to return to the Main Menu.



Click on the **Callsign** box at the top of the settings box to type in the callsign/handle of your pilot and press **Enter**. From the Multiplayer page, you may type in the **Squadron** name to be part of a team during a deathmatch. A squadron is a group of players who fly together, cooperating to reach common goals. They can also chat privately (**Shift** **T**) while in the game. If your squadron has a Password, click on the **Squadron Password** box button and enter the password. Under this, you can choose a Connection Type. Click on the arrows in the **Connection Type** box to cycle through the five possible connection types:

## Connection Types

### NovaWorld

Compete with up to 128 opponents per game in **Integrated Battle Space** on NovaWorld. The NovaLogic servers automatically host the games located on its servers. NovaWorld can be accessed through your Internet browser by selecting **Default Browser**. Select **Mini Browser** in the **Connect Via** box if your web browser

cannot open NovaWorld (for example certain versions of AOL do not support NovaWorld). The mini-browser has less functionality than most browsers (lacking the ability to use our JAVA based chat room for example). However, its small size and single purpose dedication allows it to load quicker than more powerful browsers. You should use the Mini Browser if you have set your browser so that it won't accept "cookies". Select **Join** to enter NovaWorld.

NovaLogic is dedicated to periodically updating NovaWorld with new features and enhancements. Every time you log onto NovaWorld, it will automatically check to see if you have the latest software and prepare an update, if needed.

## LAN/IPX

Up to 16 players can simultaneously play over a LAN/IPX network. Select **Host** to start a game from your computer or **Search** to find a game. Once you have located a game to play, press **Join**. You will need to type in the correct password if the Host has opted to password protect the game.



## Internet

Up to 16 players can simultaneously play over an Internet connection without being part of NovaWorld. Select **Host** to start a game from your computer. If you wish to find a game, you must first type in the IP Address of the host's computer in the **Internet Address** box, then hit **Search** to find the game. Once you have located a game to play, press **Join**. You will need to type in the correct password if the Host has opted to password protect the game.



## Serial Cable

You can play F-16 Multirole Fighter against a single human opponent by using a **Serial Cable** (commonly referred to as a "null-modem cable") to direct connect your two computers. You will need to tell the program which **Com Port** you will be using. Select **Host** to start a game from your computer or **Search** to find a game. Once you have located a game to play, press **Join**.



## Modem

Two players can play F-16 Multirole Fighter over a **Modem** connection. If you wish to host the game, simply press the **Host** button to go to the next screen. Your computer will then wait for the other player to call in. If you intend to join a game on someone else's computer, type in the phone

number of the host in the **Phone #** box, then press **Join**.

## Multiplayer Game Types

There are two types of multiplayer games in which you may participate. **Deathmatch** games are you and your F-16 against the world, where the only object is to down as many of your fellow players as possible. **RAW** games require the participants to work together to accomplish common mission goals. The **Host** of a given game selects which type it will be.

### Deathmatch Games

A **Deathmatch** game is just that, a fight to the finish, with every pilot seeking only to kill or be killed. A **Deathmatch** game differs from a normal F-16 mission in several respects:

- All players start on different airfields, typically inside an imaginary circle about 80 miles across.
- All players are invulnerable for 45 seconds after take-off.
- There are no Ground Targets in Deathmatch play.

- You can rearm and refuel your F-16 by landing it at any runway. Unlike the single player version, ground crews will repair all damage. You must bring the aircraft to a complete stop to have this take effect.
- You cannot Pause the game.
- You cannot Eject from a crippled airplane. Hit **enter** to restart at base.
- If you are killed in any way, the game removes one kill from your total.
- You will not have a Wingman.

## RAW

The object of a RAW game is to bomb the opposing team's base completely. When you start the game, it will ask you to select which side to join and whether you would like your loadout to be that of a bomber or a fighter. Most of the rules are the same as with Deathmatch, except:

- Each team is given an AWACS to provide radar coverage. Destroying the other teams AWACS is a valuable tactic.
- The players are responsible for flying CAP around their base, protecting their AWACS, escorting bombers, and intercepting enemy forces.

## Hosting a Game

To host a multiplayer **F-16 Multirole Fighter** game, press the **Host** button at the bottom of the Multiplayer screen. This brings up the **Host Options**. If you are the host, other players will have to **Join** your game. You have a number of choices to make:



- **Game Name**—Enter a unique name to identify your game. When other player's search for your game, they will see this name in the **Sessions** on their Multiplayer screen.
- **Session Password**—If you wish to restrict access to your game, enter a **Session Password** here. Only players who know the password will be able to **Join** a password-protected game. You do not have to require a password. Leave this box empty if you do not want players to have to enter a password to join your game.

- **Server Type**—Choose **Serve Only** or **Serve and Play**. If you will be playing in games you host on your computer, choose **Serve and Play**. The host should always be the person with the fastest computer setup. If you will have a dedicated server for hosting the game, choose **Serve Only**. The game will play faster with a separate unused computer acting as the server. Once you hit **Accept**, you will see a server only screen with various relevant information. Hit **[ESC]** to exit this screen.

- **Game Type**—Select a **Deathmatch** or **RAW** game type for this game. See **Multiplayer Game Types** earlier in this chapter for a description of these choices.

- **Status**—This box tells you if your other players are logged in.

- **Max. Players**—Use the arrow buttons to increase or decrease the **Maximum Number of Players** allowed to **Join** this game. This varies depending on the type of connection you establish.



- **Blackouts**—Choose the Blackouts/Redouts option to be either **Enabled** or **Disabled** for all players, regardless of their personal option selection.

- **Spin Only Deaths**—For **Deathmatch** games only. Choose **Yes** or **No**. Normally, pilots shot down in a Deathmatch game find themselves back on a random runway, ready to get back into the fray. If you select **Yes**, aircraft hit in the air will go into a spin for a few seconds, then revert to player control, all damage repaired. However these aircraft will still be spinning, so you'll have to pull out of the spin manually. Choosing **No** here puts pilots back on the ground when they are shot down, with a brand new airplane.

- **GPS Guidance**—For **RAW** games only. Select disable if you want to turn off the targeting box on the CCIP HUD mode.

- **Time of Day**—Pick the Time of Day at which you want this mission to be flown.

- **Region**—Cycle through the list of Regions to play in, such as desert and glacial.

- **Terrain Sequence**—Select **Cycle Regions** to have the computer switch to the next region on the region list when the Terrain Changes. **Cycle Times** will change only the Time of Day. With

**Random** selected either the Region or the Time of Day will shift randomly during Terrain Changes.

- **Rounds Until Terrain Change**—After the goal of the current round is met, the host will automatically start a new round. Select how many rounds will be played before the terrain changes. When it changes, it will do so according to the order you have selected in Terrain Sequence.
- **Kills per Round**—For **Deathmatch** games only. Choose how many kills a player has to achieve to end the current round. When any player reaches this total, the round will end.
- **Bombers get SRM**—For **RAW** games only. Allows planes configured to be bombers to also carry a light load of air-to-air missiles for self-protection.
- **SRMs**—If you have selected a **Deathmatch** game, choose the number of short ranged missiles each aircraft in the game will carry. This choice is not available in **RAW** games.
- **MRMs**—In **Deathmatch** games, you must choose how many medium ranged missiles each plane will carry. This choice is not available in **RAW** games.
- **Side Selection**—For **RAW** games only. **Enabled** allows players to choose which side of the battle they fight for. **Disabled** means that the computer will assign teams.

Click on **Accept** to start the game with your computer as the **Host**. You will find yourself on the end of a runway, ready to get into the air. Other players will **Join** your game whenever they wish. They do not have to sign up at the beginning of the game. They can also leave your game at any time, without affecting the other players.

## ***Integrated Battle Space***

**Integrated Battle Space** is a revolutionary multiplayer gaming environment where you play F-16 games with people who own compatible products by NovaLogic, such as **MiG-29 Fulcrum™** and **F-22™ Raptor™** (with purchased update). This not only adds an exciting challenge to your gaming experience, but also allows you to experience the strategic advantages each aircraft has over the others in a true combat situation. Additional products will be announced on NovaWorld and the NovaLogic Website ([www.novalogic.com](http://www.novalogic.com)).



# **Glossary**

## **A**

**AAA-** Anti-Aircraft Artillery. Pronounced "triple-A," this term refers to antiaircraft guns.

**AAM-** Air-to-Air Missile. A missile designed to be fired from an airplane, with the intention of hitting another airplane.

**AB-** Non-US Air Base.

**ACM-** Air Combat Maneuvers. The basic movement techniques of air fighting, including the Immelmann and the Split-S.

**ADA-** Air Defense Artillery. Ground units that operate AAA.

**AFB-** Air Force Base. A base inside the United States. An air base in a foreign country is termed an AB-Air Base.

**Afterburner-** A device for pumping raw fuel directly into the engine exhaust, dramatically increasing both engine power and fuel consumption.

**AGL-** Above Ground Level. One way to measure altitude, in units from the surface of the earth directly below.

**AGM-** Air-to-Ground Missile. A missile fired from an aircraft at a target on the ground.

**AIM-** Air Intercept Missile. The type prefix for U.S. air-to-air missiles, such as AIM-9 and AIM-120.

**Airspeed-** The velocity of the plane in relation to the surrounding air.

**Altimeter-** An instrument that measures altitude by monitoring differences in air pressure.

**AMRAAM-** Advanced Medium Range Air-to-Air Missile. The AIM-120 AMRAAM uses Active Radar Homing (ARH), so it is a "fire and forget" missile.

**Angels-** Thousands of feet. "Angels 10" equals 10,000 feet.

**Anti-radiation missile-** A missile that locks onto radio frequency radiation, such as the HARM.

**AoA-** Angle of Attack. The angle between the aircraft's wings' mean chord line and the relative wind.

**APG-68-** Multimode radar system on the F-16.

**Armstrong-** Weapons are armed.

**ASL-** Above Sea Level. Another way to measure altitude, in units above sea level. Sometimes referred to as MSL (Measured from Sea Level).

**Aspect angle-** The angle between the flight path of an attacking aircraft and that of its target.

**ATO-** Air Tasking Order. A schedule of what targets are to be hit, who is to hit them, and with what.

**Autopilot-** Flight control system feature, allowing the computer to fly the plane toward the next programmed Steerpoint.

**Avionics-** Electronic gear aboard an aircraft. Specifically refers to devices that help fly or navigate the aircraft.

**AWACS-** Airborne Warning and Control System. A powerful and sophisticated suite of radars and communications gear carried aboard an aircraft. An AWACS aircraft controls air combat operations over a wide area.

## **B**

**Bandit-** An aircraft positively identified as an enemy.

**Bank-** Rolling your aircraft to the left or right such that your lift vector is not vertical.

**BARCAP-** Barrier Combat Air Patrol. Combat aircraft positioned to act as a barrier against enemy aircraft passing through or past a given area.

**BDA-** Bomb Damage Assessment. A post-strike report on the damage caused to a particular target.

**Beaming-** An aircraft approaching from the side is said to be beaming.

**Bear-** NATO code name for the Russian Tu-95 turboprop bomber.

**Bearing-** Relative direction, in degrees. The front of the aircraft is always 0 degrees, so a target bearing 270 degrees is directly to the left.

**BFM-** Basic Flight Maneuvers. The standard air maneuvers that every pilot should know. They include the turn, break, loop, and roll.

**Bingo-** An aircraft with only enough fuel to return to base is at bingo fuel.

**Bitchin' Betty-** Pilot slang for the female voice of the onboard computer.

**Blackjack-** NATO code name for the Russian Tu-160 high speed low altitude bomber.

**Blackout-** Loss of vision due to high positive-G forces. Blood draining from the eyeballs causes this condition.

**Blip-** An image on the radar screen annotating a detected object.

**Bogey-** An aircraft whose identity has not yet been positively established.

**Bull's eye-** A bull's eye is an arbitrary predetermined map coordinate used as a navigational point of reference by friendly forces.

**Buster-** Slang term for the afterburner, or for using it.

**BVR-** Beyond Visual Range. A target that is too far away to be seen with the naked eye. Also refers to missiles designed to engage such targets.

## C

**Callsign-** A code name given to a particular fighter pilot for reasons of identification.

**Cans-** Another slang term for the afterburners.

**CAP-** Combat Air Patrol. A defensive flight over a particular location.

**CAS-** Close Air Support. The practice of using aircraft to attack enemy ground forces in conjunction with friendly troops.

**C3I-** Command, Control, Communications, and Intelligence. The basic functions of battlefield management.

**Chaff-** Metallic strips dropped from a fighter that can interfere with missile radar signals.

**Check fire-** Cease firing, or don't fire.

**Closure-** Rate at which two objects are approaching one another.

**Coaler-** NATO code name for the An-72P maritime patrol aircraft.

**Cold-** Retreating. A bandit is cold if it is leaving the combat zone.

**COMMS-** Communications.

**Contrails-** Vapor trails generated from an aircraft during high G maneuvers.

**Corner velocity-** Minimum speed necessary to pull the maximum rated Gs of an aircraft.

**Cossack-** NATO code name for the mammoth An-225 cargo plane, the world's largest aircraft.

**CSAR-** Combat Search and Rescue. The process of locating and recovering downed pilots in a combat zone.

## D

**Dead-reckoning-** To navigate without the assistance of instruments.

**Death dot-** The small aiming mark in the center of a target reticule. Also referred to as the "pipper".

**Ditch-** To put an airplane down in the water. Alternately, to eject, especially over water.

**Dry thrust-** The power of an aircraft's engines, without afterburner. Measured in units of weight, as in "15,000 pounds of thrust."

## E

**ECM-** Electronic Counter Measures. Electronic means of interfering with an enemy radar or radio transmission. Jamming is a form of ECM.

**Egress-** To exit. The route an aircraft takes out of the area after striking a target.

**Engage-** Begin Air Combat Maneuvers against the enemy.

**Envelope-** Effective range and positioning of aircraft or missiles.

## F

**Falcon-** Designation for the F-16. Sometimes referred to as the Fighting Falcon or the Viper.

**Fantan-** NATO code name for a Chinese-built fighter-bomber.

**FEBA-** Forward Edge of the Battle Area. Modern term for "the front lines".

**Fire and forget-** Indicates a self-guided weapon that does not require the pilots attention after being launched.

**Flak-** Nickname for antiaircraft gunfire. Derived from Fliegebawerkanon, a German WW II antiaircraft gun.

**Flanker-** NATO code name for the Russian Su-27 air superiority fighter.

**Flaperons-** Control surfaces on the F-16's wings that allow it to roll about its longitudinal axis.

**Flare-** A pyrotechnic released from an airplane to fool the infrared sensors on heat-seeking missiles.

**Flaps-** Hinged surfaces on the wings of an aircraft used to generate extra lift.

**Flogger-** NATO code name for the MiG-27 fighter-bomber.

**FLOT-** Forward Line of Own Troops. A line behind which friendly forces are operating, and beyond which only enemies roam.

**Fly-by-wire-** Computer system that controls the plane based on input from the pilot's flight stick.

**FOB-** Forward Operating Base. A temporary base close to the combat zone set up to support flight operations.

**FOX 1-** Pilot warning of the launch of an AIM-7 Sparrow radar-guided missile.

**FOX 2-** Pilot warning of the launch of an AIM-9 Sidewinder heat-seeking missile.

**FOX 3-** Pilot warning of the launch of an AIM-120 AMRAAM radar-guided missile.

**Foxbat-** NATO code name for the MiG-25 fighter.

**Foxhound-** NATO code name for the MiG-31 interceptor.

**Fulcrum-** NATO code name for the MiG-29 air superiority fighter.

**Full grunt-** Full Military Power; throttle setting of 100% thrust.

**Full Military Power-** 100% thrust.

**Fur ball-** A frantic multiple-aircraft engagement at close ranges.

## G

**G-** Pressure exerted by gravitational force. Standing on the ground equals 1 G.

**G suit-** A suit designed to help the pilots counter blackouts during high G maneuvers.

**GPS-** Global Positioning System. Satellite-based navigation system that allows a receiver to locate itself within a few meters.

**Guard-** Listen to the common radio frequency. You will often be asked to “monitor guard” to pick up vital information.

## **H**

**HARM-** High Speed Anti-Radiation Missile. A missile that tracks a radar emission, and attacks the transmitter.

**Havoc-** NATO code name for the Russian Mi-28 ground-attack helicopter.

**Heat signature-** The image of an aircraft as seen on infrared systems.

**Heater-** Pilot slang for an infrared homing (heat-seeking) missile.

**Heading-** Direction of flight, in compass degrees. Due east is a heading of 90 degrees.

**Helix-** NATO code name for the Russian Ka-29 light attack helicopter.

**Hot-** Bandit is approaching, or entering the combat zone.

**HOTAS-** Hands On Throttle and Stick. A modern method of cockpit design, where one does not have to remove one's hands from the flight controls to operate other aircraft systems, especially weapons.

**HUD-** Head-Up Display. A flight information technique that places most flight and combat information on a transparent panel directly in front of the pilot.

## **I**

**ILS-** Instrument Landing System. A device that allows aircraft to land safely at night and in low visibility conditions.

**Ingress-** To enter. The route followed to approach a strike target.

**IP-** Initial Point (or Ingress Point)-The map location where a strike package begins its approach to a target.

**IR-** Infrared. A band of radiation just below visible light in frequency. Infrared radiation is associated with heat sources, and so can be used to track objects with heat signatures.

## **J**

**JDAM-** Joint Direct Attack Munition. The JDAM mates a normal Mk. 83 1000-pound bomb, a set of control surfaces, and a GPS receiver to make a weapon capable of striking within a few meters of any selected ground location.

**Jinking-** A series of erratic maneuvers designed to throw off an enemy gun attack.

## **K**

**KIAS-** Knots Indicated Air Speed. The aircraft's velocity, in nautical miles per hour.

**Kts.-** Knots or nautical miles per hour.

## **L**

**LGB-** Laser Glide Bomb. An LGB glides to its target, like the JDAM, but uses reflected laser energy for guidance instead of the GPS.

**LO-** Low Observable. An aircraft designed not to reflect radar energy or visible light. Stealthy.

**Lock on-** To acquire a target with radar with the intent to fire a weapon.

**LZ-** Landing Zone. A temporary landing place, usually for helicopters or short-field aircraft, directly in a combat area.

## **M**

**Mach-** The speed of sound at sea level. Approximately 760 ft/sec. This value changes with relative air pressure.

**Mainstay-** NATO code name for the Russian A-50u airborne warning aircraft.

**Maverick-** Nickname for the AGM-65 air-to-surface missile.

**Mayday-** An emergency call, from the French m'aidez- "help me."

**Military power-** 100% thrust.

**MFD-** Multi-Function Display. Cockpit monitors which the pilot can configure to display a variety of flight, combat, and navigation information.

**MSA-** Minimum Safe Altitude. Altitude below which you are asking for trouble.

**MSL-** Measured From Sea Level. Also referred to as ASL (Above Sea Level)

**Muzzle flashes-** AAA fire.

## N

**NATO-** North Atlantic Treaty Organization formed in 1949 for purpose of collective defense against aggression.

**Nautical mile-** One-sixtieth of a degree of latitude, measured at the equator, which is one-sixtieth of a degree of longitude, or 2026 yards, or 1.15 miles.

**Negative-** A non-affirmative response; no. The opposite of "roger."

**No joy-** No visual or radar contact with enemy aircraft. The opposite of "tally-ho!".

**NOE-** Nap-of-the-Earth flying- Flying as low as possible to avoid radar detection.

## O

**OTH-** Over the Horizon. Usually refers to targets masked by the curve of the earth, or to missiles that can strike such targets.

## P

**Padlocked-** Being unable to take one's eyes off a target for fear one will be not be able to find it again.

**Pickle-** To release ordnance, as in pickle a bomb.

**Pipper-** The small aiming mark in the center of a target reticule. Also referred to as the "death dot".

**Pitch-** Measure of aircraft motion around its lateral axis. The elevators control pitch.

**Pop-up-** A sudden climb from low altitude, usually as part of the bomb delivery process. Also called popping.

**Punch out-** Pilot slang for eject.

## R

**Radar-** Radio Detection and Ranging. A device which detects objects by bouncing a beam of microwave energy off them, then timing the return.

**RAM-** Radar Absorbing Material. Materials that reduce the amount of energy reflected from their surface.



**Rammer-** Slang term for the AMRAAM radar-guided missile.

**Raptor-** Code name for the F-22 air superiority fighter.

**Red-out-** A temporary blindness caused by blood forced into the eyeball by negative-G conditions.

**ROE-** Rules of Engagement. A set of instruction detailing the conditions under which a pilot may engage in combat.

**Roger-** Affirmative; yes. A positive comment. The opposite of "negative".

**Roll-** Measure of aircraft motion around its longitudinal axis. Roll is controlled by the aircraft's flaperons.

**Rookie-** A pilot with very little actual flying experience.

**RTB-** Return to Base. Radio call indicating that the current mission has been aborted, and that all pilots should come home.

**RWR-** Radar Warning Receiver. A device which detects hostile radars.

## **S**

**Saddled-** In a stable flight relationship alongside another aircraft.

**SAM-** Surface-to-Air Missile. A missile fired from the ground against an air target.

**SAR-** Search and Rescue. The process of finding and recovering downed flyers.

**Scramble-** A rapid takeoff, usually as the result of an alert or other emergency situation.

**Scud-** A medium-range ballistic missile of Russian design. Not very accurate, but cheap.

**SEAD-** Suppression of Enemy Air Defenses. The process of destroying or otherwise degrading an enemy air defense system by means of strikes directed against radars, SAM sites, and AAA defenses.

**Sidewinder-** Nickname for the AIM-9 missile due to the peculiar back-and-forth motion it makes when tracking a target.

**Signature-** The electronic parameters of a radio or radar or heat from an engine.

**Silk approach-** The act of bailing out of an airplane.

**Six-** Directly to the rear. Check your six to keep from being surprised by enemy fighters sneaking up behind you.

**Shack-** Pilot slang for a bomb that impacts directly on its intended target.

**Slammer-** Pilot slang for the AIM-120 AMRAAM.

**Slick-** Clean or smooth. Refers to an aircraft with no external ordnance or equipment that could create drag or increase its radar cross-section.

**Smoke in the air-** Incoming missiles.

**Sortie-** A combat mission.

**Splash-** Indicates an air-to-air kill or weapons impact on a ground target, as in, "splash one MiG".

**Stall-** The separation of airflow from the upper surface of a wing, resulting in full or partial loss of lift. Aircraft that stall are no longer flying, they are falling.

**Steerpoint-** The F-16 pilot's preferred term for a fixed reference point entered into the aircraft's autopilot and navigational computers. Also referred to as Waypoint.

**Strike package-** A group of different aircraft assigned a particular mission.

**Strip-** Peel off; break from the formation.

**Su-34-** Russian fighter-bomber.

**Su-35-** Russian air-superiority fighter. Most deadly aircraft in the Russian inventory.

## T

**Tally-** To get a visual sighting of something.

**Tally-ho!-** Confirmed target sighted. Opposite of "no joy".

**Taxi-** To steer an aircraft while it is on the runway.

**Tracers-** Cannon or machine gun projectiles with a phosphor coating that ignites on firing, allowing the shooter to follow the path of the bullets.

**Triple-A-** Antiaircraft Artillery; AAA.

**Turbulence-** Violent shaking that occurs when your aircraft approaches its Vmax or encounters conflicting winds.

## **U**

**USAF-** United States Air Force.

## **V**

**Vc-** Velocity (closure). Speed at which two objects are approaching one another.

**Vne-** Velocity (never exceed). Speed at which you begin to risk structural damage to the aircraft.

**Vmax-** Velocity (maximum). The maximum safe speed for a particular altitude. An aircraft will experience turbulence as it approaches its Vmax.

**Vector-** A direction, expressed in compass degrees; to send someone in a particular direction.

**Vertical velocity-** Rate of change in the altitude of an aircraft.

**Viper-** Nickname given by pilots to the F-16.

## **W**

**Waterline-** The artificial horizon line.

**Waypoint-** Another word for Steerpoint. A fixed reference point entered into the aircraft's autopilot and navigational computers.

**Weapons free-** Freedom to fire weapons within a given airspace.

**Weapons hold-** The opposite of weapons free. Cease firing or withhold fire.

**Winchester-** An aircraft with no ordnance left; an unarmed fighter.

**Winder-** Slang term for the AIM-9 Sidewinder heat-seeking missile.

**Wingman-** Companion plane. Combat fighters usually fly in pairs.

**WVR-** Within Visual Range.

## **Y**

**Yaw-** The motion of an aircraft around its vertical axis, controlled by the rudders. A yaw is an inherently unstable flight attitude.

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